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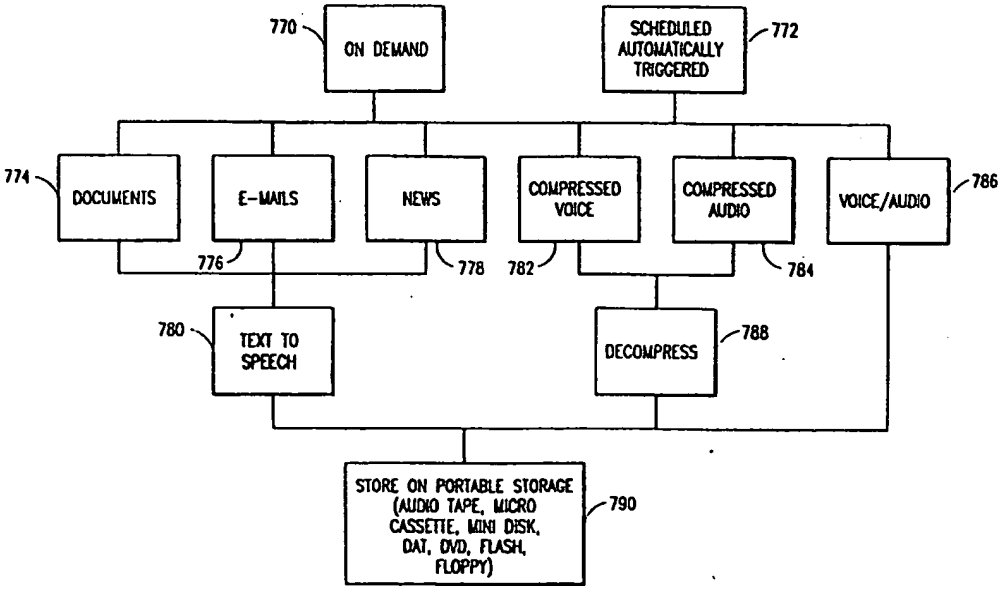

(57) Abstract

The present invention is a computerized audio system for downloading selected data as audio segments to a portable audio storage means. The computerized audio includes a processing unit which selectively retrieves data across a network, via a communication link. The processing unit then converts the selected data to analog signals and stores the analog signals on a portable storage device as audio segments. Such an arrangement allows an individual the flexibility of listening to selected data at any location or time through the use of audio system that can play the portable storage device.

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A PERSONAL AUDIO SYSTEM

FIELD OF THE INVENTION

The present invention relates to a computerized audio system and, more specifically, to a computerized audio system which can automatically and selectively retrieve and store information in an audio format on an affordable portable storage device, such as a cassette tape and Mini Disk to be played at a later time and place.

BACKGROUND OF THE INVENTION

Audio programs are known to be distributed through various channels, such as radio channels which provide audio broadcasting. Other examples of audio distribution system can be found in U.S. Patent No. 4,124,773 which discloses an audio storage and distribution system, and U.S. Patent No. 4,789,863 which discloses a Pay-Per-View entertainment system. Recently, the Internet has become another channel for on-demand audio distribution. This has been accomplished through the use of Real-Time Streaming Protocol (RTSP), such as those designed by RealNetworks Inc., located in Seattle, WA. RSTP allows for streaming of audio in real-time and live channels across the Internet.

As the Internet continues to grow, WEB sites have begun to provide a larger selection of audio programs, such as news, sports, entertainment and educational programs, examples of which can be found at www.timecast.com and www.audionet.com. Individuals can thus access a WEB site, via the Internet, and select and

receive audio programs, which are then played on a sound system in their personal computer (PC). A drawback of such an Internet delivery system is that the individual must be connected to the Internet to listen to such audio programs.

Audio programs from the Internet are also less customized than those provided by a textual source, i.e., in a text format. The Internet provides a much wider selection of information in text formats. For instance, news clipping services, such as www.individual.com, www.pointcast.com and the like, deliver customized news in text formats. However, as with audio programs, an individual must be connected to the Internet to view such textual programs.

In addition to textual programs gathered across the internet, WEB pages documents, electronic mail (E-mail) has become another popular way of receiving information and communicating with others, across a network.

One approach to ease the task of reading textual documents, E-mail, programs, etc. is to convert such textual data to a speech format. This allows the textual data to be played on a sound system of a personal computer (PC) or the like. Text-to-Speech algorithms developed by companies such as Dragon Systems, Inc., Newton, MA; Lernout & Hauspie (L&H) Speech products, Burlington, MA; Microsoft and others, enable conversion of textual data files to speech. The converted files can be played on the sound system of a PC. Other speech synthesis apparatuses are described in U.S. Patent No. 5,396,577 which discloses a speech synthesis apparatus for rapid speed reading.

Such Text-to-Speech technology are known to be employed in E-mail servers. This allows individuals to call the server and listen to their E-mail. The drawback is the cost-involved when accessing the E-mail server from outside the home, particularly if an individual wishes to listen to E-mail through a cellular phone.

There are also other computer based integrated messaging systems which integrate mail from a plurality of mail servers to handle messages of different media types, such as text and voice. Examples of such systems can be found in U.S. Patent No. 5,333,266 which discloses a method and apparatus for message handling in computer systems, and U.S. Patent No. 4,659,877 which discloses a verbal computer terminal system.

However, the above described systems and methods of accessing information provide an inflexible, time consuming and costly way of obtaining and reading or listening to information. That is, individuals must access the information source, i.e., WEB server, E-mail server and so forth, from a PC, TV-PC (which integrates the broadcast and Internet content), Network Computer (NC), Set-Top system, or the like and manually select information to be viewed or listened on the PC. although some of the information is automatically being "pushed" to the user's PC, using channels such as BackWeb and PointCast, the user still has to either view or listen to it on a computerized system such a PC. This requires that the individual spend an enormous amount of time at the PC, time which can be better spent elsewhere. With regard to the above message systems, they provide a

limited source of information (i.e., messages) and are often costly to access from outside the home.

Conventional low cost portable and non-portable audio systems (e.g.., tape cassette player), such as found in cars, hones, etc., are already employed to listen to audio programs, such as music, audiobooks, training programs and so forth stored on audio cassette tapes. Audio cassette tapes are known to be used in conjunction with computers to store and load programs. For instance, U.S. Patent No. 4,315,323 discloses a cassette recorder system for loading programs. However, there is currently no method of automatically and selectively storing information, such as E-mail and other data retrieved across a network, onto such portable storage devices as audio segments.

There is a need to provide a computerized audio system that can selectively retrieve and store information onto a portable audio storage devices (e.g.., an audio cassette tape) which can be played on conventional audio systems (i.e., a cassette player, or a Mini Disk player). There is also a need to provide more flexible, time efficient and cost effective means to listen to selected information retrieved from various sources, such as a WEB and ftp servers, E-mail server, local storage device, cable and satellite stations, radio stations, digital radio System and so forth.

It is an objective of the present invention to provide a low cost computerized audio system that can selectively retrieve and store information in an audio format onto an affordable portable audio storage device for later playback.

It is a further object of the invention to store such information onto low cost, conventional portable audio storage devices, such as a cassette tape Recordable Mini Disk and Recordable CD, which can be played at any place or time through the use of conventional audio systems.

Another object of the present invention is to provide a portable audio storage device, e.g.., an audio cassette or a Mini Disk which stores personal documents, E-mail or the like in an audio format which can be played in a car, on a train or any place with the use of a conventional audio cassette , or mini disk player.

It is another object of the present invention to store personalized audio information onto conventional tape cassettes or a mini disk in a manner that enables an individual to employ conventional cassette or mini disk player functions, such as the SKIP function, to selectively access and play the information.

It is also an object of the present invention to provide a computerized audio system which automatically retrieves selected information from any remote location, such as the Internet, cable TV, radio or satellite communication, and stores such selected information onto a portable storage device as audio.

Another object of the present invention is to provide a computerized audio system which can automatically upload and transmit information, such as an E-mail reply, from an audio cassette, or a digital solid state audio storage.

It is another object of the present invention to provide a remote controlled audio system for playing the personalized audio information stored on a portable storage device and, more specifically, a remote controlled audio system in a motor vehicle which allows a vehicle operator to drive safely while listening to the audio information and remotely controlling the audio system, such as using the SKIP function.

SUMMARY OF THE INVENTION

The present invention is a computerized audio system for downloading selected data as audio segments to a portable audio storage means, such as an audio cassette. The computerized audio system includes a processing unit which selectively retrieves data across a network, via a communication link, or from internal or external storage. The processing unit then converts the selected data to analog signals and stores the analog signals on a portable storage device as audio segments. The selected data can be in a text, voice or audio format and may correspond to various information, such as electronic mail (E-mail) in text or audio format, documents, news, educational materials, audio programs, music, entertainment programs, audiobooks or any type of information that can be converted, if necessary, and played in audio form.

Such an arrangement provides a low cost system that employs affordable and commercially available components and allows an individual the flexibility of listening to selected data at any location or time through the use of

an audio system that can play the portable storage device.

Although it is preferred that the audio segments are stored on conventional audio cassettes, the present invention may also be employed with other known portable audio storage devices. For instance, the present invention may store selected audio segments onto a Recordable Mini Disk (MD), Digital Tape (DAT), Recordable Compact Disk (CD), Recordable Video Disk (DVD), a FLASH memory card or equivalent. It is also preferred that the computerized system is a personal computer (PC), Network Computer (NC), PC-TV (which integrates TV and PC functionality), or Set-Top system. In this case, the computerized system can also be configured with an ability to mute the computer speakers to eliminate noise when recording the audio segments onto the portable storage means.

In addition to recording selected data on portable storage means, the computerized audio system can also store various types of codes on portable storage means. Such codes may include a code to mark each audio segment, to identify each audio segment and to provide security (e.g.., identifying the source from which the audio segments were originally copied, or using a Serial Copy Management System to allow only first-generation digital copies to be made of premastered software.).

The present invention also provides a computerized audio system that can automatically receive audio segments according to predetermined criteria from a remote source, such as a server, or automatically prepare audio segments according to predetermined criteria or on-

demand. That is, the computerized audio system can be automated to retrieve selected data from a variety of data sources, i.e., WEB server, E-mail server, internal storage device, etc. and to download selected data onto the portable storage means. For example, the computerized audio system can automatically and selectively download E-mail, or documents in an audio format onto an audio cassette, or as a digital audio format onto a Recordable Mini Disk.

The present invention also provides a computerized audio system that can automatically receive audio segments in digital audio formats (such as RealAudio) which are designed to be played on a computerized system (such a PC), and automatically process and reformat them to be stored on a conventional portable storage device such as cassette tape or Mini Disk so a conventional storage device player can play them as audio.

The present invention also downloads audio segments onto the portable audio storage unit in a manner which allows use of conventional functions, such as the SKIP operation of conventional tape cassette, or Mini Disc players and audio systems. For instance, this is accomplished by inserting silence segments or an equivalent thereof onto a magnetic audio cassette tape, or writing different audio segments to different sections or tracks in a Mini Disk to enable an individual to skip between audio segments stored thereon. Furthermore, in an alternative embodiment, voice messages associated with the audio segments can be recorded on the same portable storage device storing the audio segments being played.

The computerized audio system can also upload recorded voice messages (i.e., E-mail replies) stored on the same portable storage means with the audio segments. Such voice messages can be stored in corresponding relationship to an audio segment. Once retrieved the computer audio system can then automatically forward the voice messages to an appropriate destination.

The present invention also provide a remote controlled personal portable audio system which includes a portable storage device player, such as a tape player or a Mini Disc player and a remote controller which enables a vehicle operator to drive safely whiled listening to stored personalized audio information and remotely controlling the portable storage device player to perform functions (e.g., the SKIP function) to selectively access and play the audio information. The present invention further includes transmitting the audio to an external audio system, such as a car stereo to be heard through the car speakers.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

Fig. 1A illustrates a first embodiment of a computerized audio system with a computerized system (i.e., a personal computer) interconnected to an audio system (e.g.., a cassette or Mini Disc recorder), in accordance with the present invention;

Fig. 1B illustrates a personal audio system for playing a portable storage means, i.e., an audio cassette for storing customized audio segments of Fig. 1A of the present invention;

Fig. 1C illustrates an alternative embodiment of the computerized system of Fig. 1A of the present invention;

Fig. 1D illustrates an alternative embodiment of a personal audio system of Fig. 1B installed in a motor vehicle and operated with a remote control;

Fig. 2 is a block diagram of a personal audio system to record a portable storage means of Fig. 1A;

Fig. 3A is a schematic view of the use of a magnetic head to record audio segments onto an audio cassette as performed by the computerized audio system of Fig. 1A;

Fig. 3B is a graph which illustrates a typical behavior of the magnetic head of Fig. 3A;

Fig. 4A is a schematic view of an audio tape cassette format for storing audio segments of the present invention;

Fig. 4B is a flow diagram of data flow as performed in the present invention shown with various security means along the data pathway;

Fig. 5A is a schematic view of a second embodiment of the components of a computerized audio system of the present invention;

Fig. 5B is a block diagram of the components of a computerized audio system of Fig. 5A;

Fig. 5C and 5D are schematic diagrams of a computerized audio system of Fig. 5B;

Fig. 6A schematically illustrate a third embodiment of computerized audio system of Fig 1A;

Fig. 6B schematically illustrates a fourth embodiment of computerized audio system of Fig. 1A;

Figs. 6C and 6D are exploded block diagrams of computerized audio system of Fig. 6B;

Fig. 6E illustrates a fifth embodiment of a computerized audio system;

Fig. 7A is a schematic illustration of various modes of operation of a computerized audio system of the present invention;

Fig. 7B is a flowchart illustration of a preferred operation of a computerized audio system of the present invention;

Fig. 7C is a flow diagram of a preferred operation of an electronically controlled cassette version of a computerized audio system of the present invention;

Fig. 7D is a flow diagram of a preferred operation of a voice controlled cassette version of computerized audio system of the present invention;

Fig. 7E is a flow diagram of a storage operation of user responses, such as a voice comment, on a portable storage means, in this case a Mini Disk.

Fig. 8A illustrates an alternative embodiment of a modified portable storage means of Fig. 1A;

Fig. 8B is an exploded view of the modified portable storage means of Fig. 8A;

Fig. 8C schematically illustrates the storage format of the modified portable storage means of Fig. 8A; and

Figs. 8D and 8E are block diagrams each illustrating an alternative embodiment of an audio system of Fig. 1A.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

Before proceeding with a detailed description of the present invention, it is well to define certain terms to be used herein. The term "data" refers at a minimum to data in text format, data in audio format, voice data or any data capable of being stored in an audio format on a portable audio storage device, such as a cassette tape, Mini Disk (MD), compact disc (CD), DVD, digital audio tape (DAT), digital memory (i.e., Flash EEPROM), or equivalent and can be audibly played and listened on an appropriate audio system. It is important to understand that such data can be in any format retrievable by a computerized system (e.g., a personal computer). Such

data may relate to electronic mail (E-mail) in text or audio format, documents, html pages, news, educational materials, audio programs, music, entertainment programs, audiobooks or any type of information that can be converted, if necessary, and played in audio form.

An "audio segment" will hereinafter refer to data which are stored onto a portable audio storage device in a format which can be audibly played. This may require data to be converted to such format prior to storage. The format of the audio segment is dependent on the original format of the data (i.e., digital, analog, text, voice, audio, etc.), the particular type of portable audio storage device and the audio system for playing the storage device. For instance, data in the form of textual E-mail can be converted to audio segments for storage on a conventional audio cassette tape. In this case, the E-mail data is converted to speech using a Text-to-Speech converter (i.e. converted from digital text data to voice data) for storage digitally onto a Mini Disk or further converted to analog voice signal for storage onto analog magnetic cassette tape, or analog input of a Mini Disk.

Turning to a detailed description of the present invention with reference to Fig. 1A, a first embodiment of computerized audio system 10 includes an audio system 100 for recording audio segments onto a portable storage means 200 (e.g.., an audio cassette). Computerized audio system 10 also includes a computerized system 600 for automatically retrieving selected data (locally or remotely) and transmitting the selected data to audio system 100, across a communication link 104, for storage as audio segments on portable storage means 200.

Computerized audio system 10 can thus automatically and selectively retrieve data from a remote or local storage device and, subsequently, store the selected data as audio segments on portable storage means 200. Portable storage means 200 can later be played at any time or place, preferably through the use of an audio cassette, or Mini Disk player 200.

Audio system 100 includes a recorder 110, operating keys 106, communication port 102, and portable storage means 200 for storing audio segments. Recorder 110 can be activated either automatically by computerized system 600 or manually (via operating keys 106) to store audio segments on portable storage means 200. Portable storage means 200 can be an ordinary size audio cassette, Mini Disk, microcassette, a special cassette as described later in Fig. 7A or any portable audio storage device that is capable of storing audio segments that can be audibly played.

Accordingly, the present invention enables a user to make better use of time by listening to selected information, such as E-mail, news, documents, and so forth, at any location and time with the use of conventional audio systems. The present invention further provides an affordable system which employs low cost components, such as the commonly available audio cassette or Mini Disk, audio recorder, communication components and computerized system means (e.g.., PC), all of which are commercially available at affordable prices. Furthermore, the audio format in which audio segments are stored on portable storage means 200 enables the user to save additional time by skipping and repeating audio segments in a random sequential manner using common

functions provided on audio system 100 (e.g., Automatic Music Search (AMS) of a cassette player, or track skip in a Mini Disk)

Referring to Fig. 1B, portable storage means 200 can be played on another personal audio system 500 (e.g.., a cassette or Mini Disk player), such as a playback deck of personal audio system 500 or on a detachable audio system 100 (Fig. 1A). A listener 540 can control the operation of personal audio system 500 (i.e., PLAY, REWIND, SKIP, MARK, RECORD, etc.) through the use of a remote control 510, a voice command, or manual controls. Personal audio system 500 and remote controller 510 can be incorporated into a motor vehicle, as shown in Fig. 1B.

For instance, remote controller 510 can be an integral part of a wheel system 530, installed within the steering wheel 530, or positioned at any location preferably within reach of the vehicle operator to provide a remote controller arrangement that is easy and safe to use. Remote controller 510 preferably includes keys and communication means for controlling the operation of personal audio system 500. Communication means can be an electrical cable or wireless communication, i.e., Radio Frequency (RF) or Infra Red (IR) transmission. A listener 540 can thus play audio segments stored on portable storage means 200, or skip between different audio segments using the remote controller 510 to control the personal audio system 500.

Fig. 1C illustrates an alternative embodiment of computerized system 600 which can take the form of a cable set-top system. Computerized system 600 includes a

television set 654, and a set-top box 650 for providing interconnection to a network across a communication link 652. Step-top box 650 may include a processor unit (not shown) which can be configured to selectively retrieve data across a network and to convert (if necessary) the selected data to audio segments for storage onto portable storage means 200, 210 or 220 in audio system 100. For instance, conventional cable box step-tops are known to provide a programming option to preset the time and channel for recording. A PC-TV which integrates the capabilities of a TV and the Internet enables the user to retrieve textual information as well as digital audio formats segments and convert them to audio. An appropriate audio system 100 can be selected to record selected data onto audio cassette 200, Mini Disc (MD) or recordable CD 210, a floppy disk 220 or equivalent.

Fig. 1D illustrates an alternative arrangement for remotely controlling another personal audio system 100 with remote controller 510, such as an RF, IR or wired remote controller. In this embodiment, the remote commands are received via remote control link 512. This causes personal audio system 100 to retrieve audio segments from portable storage means 200 and play them. The remote command signals can be transmitted using a link 512, such as RF transmission . The audio segments produced by the portable personal audio system 100 can be played on a regular audio system 500, such as a car stereo. The audio signals can be transmitter using a link such as RF transmission 514 (Fig. 2) or through the use of a cassette adapter, such as in U.S. Patent No. 4,734,897 which discloses a cassette adapter for a playback device. The personal audio system 100 can contain a microphone input to receive audio signals 516

to be recorded on storage mean within the personal audio system 100, or marking means to electronically mark audio segments for later use . Referring to Fig. 2, computerized system 600 includes a processing unit 620 for managing the internal operations, such as selecting, retrieving, aggregating, converting, and transmitting data for storage. In particular, processing unit 620 (i) selects and retrieves data to be stored according to predetermined criteria or on-demand, (ii) converts data from Text-to-Speech formats depending on the format of the retrieved data, (iii) converts data to an audio format (i.e., audio segment) according to a format of the data and a format employed by portable storage means 200, (iv) compresses and decompresses audio segments (if necessary), (v) manages communication processes of computerized system 600, and (vi) controls the operations of storing data on portable storage means 200 as audio segments. Processing unit 620 can be a 80x86 or a Pentium processor manufactured by Intel Corporation, or a RISC processor such as SH3 of Hitachi, ARM- Advanced RISC Machines ARM or equivalent.

It important to understand that processing unit 620 can be configured to automate the process of accessing and retrieving selected data, across communication link 610 or from internal storage 602 according to predetermined criteria. Such predetermined criteria may include a particular type of information, such as E-mail, documents, news, education programs, music, etc.; a particular data source, such as a WEB site (e.g.., www.pointcast.com); a particular topic, such as sports, technology, etc.; and so forth. Such an arrangement eliminates the need for manual access and retrieval of selected data. This processes can be timed to start

automatically in the morning before the user commutes to work, so the user can better utilize his commuting time. Processing unit 620 can organize all data according to a user selection and automatically reformat and convert it to an audio format suitable for storage on portable storage means 200.

Computerized system 600 also includes local storage unit 602 to store programs or subroutines, such as communication software (e.g.., web browser), compression/decompression software, text-to-speech software and so forth. Local storage unit 602 may also store data in text, audio or other format. Local storage unit 602 can be a hard disk, optical disk, flash memory card, random access memory (RAM) or the like.

A communication port 622 provides interconnection (via communication link 610) across a network through the use of a regular telephone modem, ISDN modem, Cable modem, satellite modem, Ethernet, Digital Subscriber Line/Asymmetric Digital Subscribe Line (DSL/ADSL) or other serial communication means. Communication port 622 enables processing unit 620 to retrieve or download selected data, such as E-mail, news, educational programs, and so forth. Computerized system 600 can thus retrieve selected data through the Internet, Intranet, TV, Cable TV 650 (Fig. 1C), satellite receiver, optical link, Digital Subscriber Line/Asymmetric Digital Subscriber Line DSL/ADSL, radio, or paging network. It should be noted that data can also be retrieved from internal storage 602 of computerized system 600.

It is preferred that computerized system 600 is a personal computer (PC) with sound capabilities such as Sound Blaster card of Creative Labs as an audio port 616. However, computerized system 600 can also be any electronic personal computer such as Window CE based computers (such as Windows CE PDAs offered by NEC, Hewlett-Packard, Philips and others , electronic personal organizer, such as Pilot manufactured by U.S. Robotics, USA; a Set-top system, such WebTV developed by WebTV Networks, Palo Alto, CA (denoted by reference number 650 as shown in Fig. 1C); PC-TV such as NC TV of Network Computer, Inc. CA and FUNAI Japan, which integrates the broadcast and Internet content, or cable modem.

In operation, upon a user request or according to an occurrence of a predefined event, computerized system 600 selectively retrieves data according to predetermined criteria, from external links 610 or internal storage 602. Computerized system 600 then prepares and aggregates the data. The preparation may include converting data to audio segments with an appropriate format depending on the format of the data (e.g.., converting text to speech).

For instance, in the case that portable storage means 200 is a magnetic tape (i.e., analog device), data in text formats can be converted from text to speech using Text-To-Speech (TTS) algorithms, such as one developed by Lernout & Hauspie Speech Products Burlington, MA. The TTS algorithm is performed by processing unit 620 of computerized system 600 to convert data in textual format to audio segments for storage on portable storage means 200. Thereafter, the aggregated data is then transmitted as audio segments to audio

system 100, across communication link 104. Recorder 110 receives the audio segments and stores them on portable storage means 200.

Referring to Figs. 1A and 2, a preferred audio system 100 includes a housing, recorder 110 with portable storage means 200 for storing audio segments; audio interface 124 and local control means 140. Audio system 100 also includes communication port 102 which is connected to computerized system 600, across communication link 104 (e.g. an electrical or optical cable) to allow transmission of audio segments and commands therebetween. Communication link 104 can be stereo audio cables 104A and control cable 104B. Communication link while implemented for digital transmission can utilize the same cable by multiplexing the different signals. Audio system 100 may also include other input means 104, such as a remote control interface to allow receipt of command transmissions, such as RF remote control signal 512 (Fig. 1D), or audio commands 516.

Audio system 100 can take the form of a Walkman, portable MD recorder, microcassette tape recorder, a special hand held device or the like. Audio storage means 200 can be a magnetic audio cassette tape (such as described in Fig. 1A), a solid state memory such as Flash EEPROM memory manufactured by Intel Corporation, Recordable Mini Disk such as manufactured by Sony Corporation, or the like. Recorder 110 can be tape cassette recorder/player, Mini Disk system, or the like. If storage means 200 is a Recordable Mini Disk computerized audio system 600 can provide either a

digital, or analog audio format through communication link 104 to audio system 100.

Control means 140 can be a microprocessor integrated circuit (IC), such as an 80C51 manufactured by Intel Corporation, USA, a digital signal processor (DSP), such as 320C2xx manufactured by Texas Instruments, or the like. Control means 140 controls the operation of audio portable storage means 200, across control lines 120A. While implemented with a tape recorder, the control lines 120A can include signals such as MOVE-TO-BEGINNING-OF-STORAGE, START-RECORDING, STOP-RECORDING, STOP, REVERSE-DIRECTION-OF-RECORDING and so forth. The status of portable storage means 200 is monitored by control means 140 using status lines 120B. Status lines 102B can include signals, such as CASSETTE-INSERTED, MOTOR-ON, END-OF-TAPE and MOTOR-DIRECTION. If portable storage means 200 is a MD, the Local Control will monitor the track number, the remaining storage space available, and the readiness of the MD to store information, and will control the track number, RECORD and STOP functions.

Local control means 140 is connected to computerized system 600, via control port 102B and control link 140B. Control link 140B can be discrete logical lines, RS323, optical link, parallel port, Universal Serial Bus (USB) or other digital format. Control link 140B is connected to communication port 612 of computerized audio source 600.

Recorder 110 is connected to an audio interface 128, across audio line 124. Audio interface 128 is connected to audio port 616 of computerized system 600, across audio link 104A. Audio link 104A includes at least one

audio output from computerized system 600. Audio link 104A can also include an additional audio link connected back from audio system 100 to computerized source 600. This allows audio segments (e.g., recorded voice messages, marks, etc.) to be uploaded from portable storage means 200 to computerized system 600. That is, such a link allows a user to record voice messages, such as an E-mail reply on portable storage means 200; upload such messages to computerized source 600; store them on local storage 602, or attach them to E-mail replies as voice mail. Audio input/output 126 and 130 comprises routing means to transfer signals from audio link 104A, across audio interface 128, through link 124 to the recorder 110.

Referring still to Fig. 2, the present invention may employ an optional audio output 130 which enables the speakers to be connected to audio system 100. Audio Interface 128 may include another external audio input 126, such as a microphone to enable recording of voice on portable storage means 200. Audio Interface 128 may also include an analog-to-digital (A/D) converter, such as a 3054 CODEC manufactured by National, or ATRAC for MD. Audio Interface 128 may also be connected to a transmitter 132, such as an RF transmitter to transmit audio 514 to a remote audio player, such as a car stereo. Local control means 140 can also be employed to disable or mute external audio output 130 to external speakers. This enables the user to replay and store audio content on portable storage means 200, even in situations were acoustical noise is undesirable, such as in the office or during the night.

It should be noted that computerized system 600 can generate audio segments (i.e., data in audio format) in higher speed than real time and send the high speed audio to be stored on personal audio system 100. Recorder 110 stores the audio segments in a relative rate. For example, if computerized system 600 generates audio segments at double speed, recorder 110 will record the audio segments at double speed so that the recording time will be halved, but the audio segments can be played at normal speeds to produce normal speed audio. If storing means 200 is a magnetic tape, recording in double speed means that the hubs of the recorder 110 will turn twice the speed of the normal speed.

In the event that selected data is in a compressed format, computerized system 600 converts the data to audio using a matched decompression algorithm. For example, computerized system 600 may employ compression and decompression algorithms, such as an G.723, or Real Audio CODEC algorithms designed by Real Networks, Washington, USA; CODEC algorithms of Voxware Princeton, New Jersey USA; or other available CODECs. Computerized system 600 then converts audio to suitable formats to be recorded on storage means 200, transmits the decompressed audio segments to audio system 100 for storage on portable storage means 200.

In the event that portable storage means 200 is digital memory means, such as Flash EEPROM, computerized system 600 transmits the audio segments in digital format (either text, compressed voice or compressed audio) via control link 104B to audio system 100, and causes the audio segments to be stored on portable storage means

200. Upon a user command, audio system 100 converts the digital data to analog audio signals and plays audio segments stored on portable storage means 200.

In case portable storage means 200 is a digital storage device, local control means 140 begins by retrieving the audio segments. The audio segments are then converted to voice or audio through the use of decompression or TTS algorithms and, then, played through the use of audio interface 128. Audio interface 128 includes CODEC circuitry for converting digital signals to analog signals. In the alternative, an audio transmitter 134 can be connected to audio interface 128 to transmit the audio signals as FM modulated RF signals preferably within the band of 88-108 MHz and with a radiating power lower than allowed by FCC Regulation, Part 15. This will allow the user to hear the audio with the use of a regular FM radio receiver.

In an alternative embodiment, portable storage means 200 may be a combination of both an audio cassette tape and digital memory (i.e., flash EEPROM). In this case, the audio cassette tape is preferably used for storing long audio segments typically received from computerized system 600. The digital memory is preferably used to store shorter personal messages of the user and shorter audio segments received from computerized system 600.

Computerized system 600 can retrieve E-mail in text format or in voice format. E-mail in text format is converted to speech using a Text-To-Speech algorithm (as described above). The user can listen to the converted voice version of the E-mail, using audio system 100 and, moreover, mark E-mail to be deleted, replied, filed, or

forwarded by using the remote control (as described above). The user can also record a voice reply to a received E-mail, or record a new E-mail. Such replies are stored in portable storage means 200. Audio system 100 can keep track of each E-mail message as it is being played. Each mark made by the user is correlated to the E-mail currently being played. Similarly, the user can record short messages by operating remote control 510 (as shown in Fig. 1B), and speaking into a microphone connected to audio input 126 of audio system 100. The voice messages are then recorded on portable storage means 200.

Audio system 100 can also play documents or other text content converted to voice in a similar way, where the user can add vocal footnotes, while the voice format of the document (i.e., the audio segments) is being played. Similarly, the user can record synchronized messages on every audio segment that is played. If using a Mini Disk as portable storage means 200, comments in voice format will be recorded in different tracks and will be indexed according to the audio content being played before the user initiates the recording operation. An alternative way to implement such a feature is discussed below with reference to Figs. 8A through 8E.

Local control means 140 can compress the voice messages prior to storage onto portable storage means 200, or convert the voice messages to text through the use of Voice Recognition algorithms, such developed by L&H, and then store the converted messages as a text file. In any event, stored messages can be transmitted by control means 200 to computerized system 600 through a

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understand that VOX operated tape recorders usually continue recording for several seconds after audio input signal stops. However, in order to provide a long enough silence segment between each audio segment (i.e., typically of at least about 4 seconds) as required by most of tape players with Automatic Music Search (AMS) function), an intentional silence segment is inserted between each audio segment. Since the recording process can stop before an appropriate silence period required for the silence detection of a tape player is recorded, a silence segment or an equivalent thereof from a computerized audio source can be intentionally inserted instead. Such a method utilizes the voice activated feature of a VOX recorder to provide for a continuous recording of audio segments and intentional silence segments.

It has been discovered that such a silence segment may be a high frequency audio signal which is delivered to the input of the tape recorder between each audio segment. Such a signal is delivered both to the Voice detection circuitry (VOX) which detects the signal and continues the recording and to magnetic head input wires 902. A magnetic flux is produced in the input frequency and conducted in a core 900 of the head. A magnetic field is induced near the gap of core 904 to magnetic domains 908 of magnetic tape 850. At a given gap width and a given tape speed 910 and if the frequency of the input signal is high enough 914 (i.e., typically higher then 16 kHz) (Fig. 3B), the magnetic domains 906 are condensed so that there is no relation between the input signal current and the manner in which the magnetic domains are arranged on tape 906. That is to say, magnetic head is unable to record such high frequency

signals to magnetic tape 850 or, in other words, tape 906 is unable to pick up the domain changes. As a result, an equivalent of a silence segment is recorded onto tape 906, preferably between each audio segment. As shown in Fig. 3B, there is shown a cutoff point 918 in the transfer function of the combination of the head and tape to produce effectively a "silence" segment.

Alternatively, very narrow pulses can be sent to the tape recorder input to create the same phenomena of injecting input signal that operates the VOX. These signal will not be detected while being played on a tape recorder using a silence detector to skip to the next silence segment. Preferably a "silence" signal injected by a computerized system 600, will be a combination of low amplitude and high frequency spectral components.

Although the above example describes an implementation of storing audio segments on an audio cassette tape in a manner to respond to a search function of a tape player, the same concept may also be employed for other types of portable storage means 200, such as recordable MD, recordable CD and so forth. For instance, audio segments can be selectively stored or organized on different storage sectors or tracks to respond to a search function of a MD player.

Fig. 4A illustrates describes an intentional automatic silence segments insertion method on audio tape 850, of the present invention. Computerized system 600 (Fig. 1A) can organize audio segments such as 854 and 860 in a way that they are separated from one another by silence segments such as 856 with minimal duration

required for blank/silence detection in a tape. Computerized system 600 automatically inserts a silence segment of several seconds, typically 4 seconds between each E-mail message, each document, each chapter of an audio program, or as periodic silence intervals defined by a user (i.e., typically 30-60 seconds), or in any other selective manner. For example, the insertion of these silence segments can be accomplished by recording "No signal" or a "silence signal" as described with reference to Fig 3A and 3B through the use of a VOX tape recorder. The insertion of such silence segments enables a user to employ the SKIP function of audio system 100 (Fig. 1B) to skip to a previous or subsequent silence segment. It will be appreciated that the automatic silence insertion procedure of the present invention automates the process of storing customized audio programs on portable storage means 200 in a manner which enables use of the SKIP function of audio system 100. If MD or recordable CD is used, different audio segments will be stored in different tracks to enable use of the SKIP function of audio system 100.

In another embodiment, computerized system 600 can record codes on portable storage means 200. Such codes can be stored as segment codes indicated by reference numerals 852 and 858 to identify the sequential number of a specific audio segment, and to enable identification of a specific audio segment if retrieval is required (i.e., such as when an E-mail is replayed). Segment codes 852 and 858 can be formatted in multi-tone (i.e., dual-tone modulation multi-frequency (DTMF)), multiphase, or pulse modulation.

Computerized system 600 can also record a security code denoted by reference numeral 851. Security code 851 can be used as an electronic signature to identify the audio source, thereby enabling the tracking of the audio duplication source. That is to say, security code 851 can be retrieved to identify the source of the original selected data (i.e., a publisher) or the duplication source (i.e., computerized system 600). Security code 851 can be a serial number code which identifies the audio source or the user who retrieved the audio segments. It can contain the duplication number of the content stored thereon and other relevant information. Security code 851 can be formatted in multi-tone (such as DTMF), multiphase, or pulse modulation if a magnetic tape is used. Security codes 851 can be stored as a hidden file on portable storage means 200 at several places and at fixed or random locations. If a digital storage 200 is used, such as MD, the code can also contain a serial number. Computerized audio system 600 can then use a Serial Copy Management System to allow only first-generation digital copies to be made of premastered software.

Audio system 100 can also be employed to mark audio segments stored on portable storage means 200 with security codes 851. If portable storage means 200 is a digital solid state memory, audio segments can be stored in an encrypted format and opened only by playing the audio segments on a specific type of audio system 100 having an appropriate decryption scheme.

Fig. 4B illustrates data security means for computerized audio system 10 of the present invention.

Data security can be provided at several layers. A secured communication link 610 can be provided between a server 740 (i.e., the data source) and computerized system 600. Data received across communication link 610, can be encrypted to allow only specific software employing a specific user key, identifier or decryption scheme to have access to the data. Such encryption software can be an RSA which is a public-key cryptosystem for both encryption and authentication developed by RSA Data Security, Inc. Computerized system 600 can thus store the received data in an encrypted format which can only be accessed through the use of specific software using a specific user key, identifier or decryption scheme.

In addition to the above security arrangements, computerized system 600 may include software which allows only a limited number of storing operation to be performed with respect to specific data. Computerized system 600 may also be configured to require a special request for additional copies. Computerized system 600 may also be configured to trace and record the number of storing operations performed on specific data, and report such information to the original data source, such as an Internet server. This would allow a data source (i.e., remote server) to lock out storing capabilities of computerized system 600, via remote control, in cases which copyright laws are violated. Another layer of security is to store security data on storage means, as described in Fig 4a.

Figs. 5A and 5B illustrate a second embodiment of the present invention with audio system 100 having an electronic control. In particular, audio system 100 is

connected to an audio control unit 150, which is controlled by computerized system 600. The function of audio control unit 150 is similar to that of local control means 140 and audio interface 128 (as described in Fig. 2), except that, in this case, it is located in a separate package. Alternatively, this functionality can also be integral to computerized system 600.

Audio control unit 150 is connected to audio system 100, across an audio link 124 and provides an audio link between an audio interface of a computerized system 600, audio system 100 and a control link 120, used for controlling audio system 100. Audio control unit 150 can be connected to an external power source 142(or obtain power from computerized system 600 using link 104) and speakers 132 through a speakers link 130. Local control means 140 (Fig. 5B) receives control commands from a computerized system 600, through control link 104B and converts them to specific controls for audio system 100 (as described in Fig. 2). Audio interface 128 can control the routing of an audio signal at least sent to audio system 100 for recording and can also control signals sent back for storing recorded audio on computerized system 600. Audio interface 128 can also take the form of an audio interface, as shown in Fig 5C.

Referring to Fig. 5C, audio signals are received at audio interface 128, via an audio link 104A and through audio lines 104E1, 104E2 (used for stereo audio signals), connected at an initial state through lines 156A and 156B, to speakers link 130. This is accomplished through the use of Dual Port Dual (DPDT) through electronically controlled switches 152, such as an DPDT relay. Upon

receiving a recording command from computerized audio system control link 104B, a change routing command is provided to DPDT switch 152 through change port 154. As a result, switch 152 changes position and connects the audio through an optional dynamic range matching block 158, such as an attenuator. The audio is then passed through a mono-stereo selector 162 to output lines 164A, 164B, through an audio link 124, through lines 164A, 164B and finally to audio system 100 for storage. Audio output 130 to external speakers is disconnected while recording so that undesirable noise is eliminated. Alternatively (Fig 5D), two types of audio signals from computerized system 600 can be connected to audio control 150, such as Speakers-Out signal(104A3) and Line-Out signal(104A4). While the storing operation is taking place, Speakers-Cut is disconnected from the speakers. Line-Out is always connected to audio system 100 across line 124 to take advantage of a better Signal-To-Noise Ratio on this line.

Fig. 6A illustrates a third embodiment of the present invention. Recorder unit 100 can be connected to computerized system 600 through the use of an audio cable 104a only. Recorder unit 100 has Voice Operated (VOX) capability. An portable storage means 200 is inserted into recorder 100 and set to the starting point. Recorder 100 can then be set to RECORD mode. Recorder 100 waits in this position, as long as there is no audio being transmitted through audio input 102. Computerized system 600 sends audio through an audio link 104A to recorder unit 100 according to the recording process described in Fig 7B. A VOX function in recorder unit 100 detects the audio and starts the audio storing operation

on portable storage means 200. Recorder unit 100 can be a tape recorder with voice operated (VOX) recording capability, and portable storage means 200 can be a conventional audio cassette tape. Such an arrangement requires some manual preparation, such as rewinding the tape to the beginning, pressing a record key, rewinding the tape at the end of the recording process, and disconnecting the speakers for avoiding undesirable noise while recording.

Figs. 6B and 6C illustrate a fourth embodiment of the present invention which includes an additional audio switch 176 which disables external speaker noise while the recorder is connected. Input audio switch 176 is connected to the audio output of computerized system 600 and the speaker output of switch 174 is connected to speakers 132. When recorder link 104A is connected to recorder output of switch 172, speaker output 174 is disconnected to prevents them from producing any noise or sound, during the recording process. The audio switch can include three stereo switched phone jacks. Input phone jack 170 receives audio plug 104A1 to bring audio segments from computerized system 600. Input phone jack 170 is connected to input contact pads 172A of recorder phone jack 172. Switched contact pads 172b from jack 172 are connected to input connecting pads 174A of speaker phone jack 174. Accordingly, recorder audio plug 104A2 can be inserted to phone recorder jack 172 to disconnect the audio from speaker phone jack 174 and, thus, to disable the speakers. Such a switch 176 can be implemented electronically and can be implemented inside of computerized system 600.

Fig. 6D illustrates an output control of computerized audio system 10. In particular, computerized system 600 includes two audio outputs from a sound board or card 190 installed therein. The audio outputs include a line out 192 connected to an audio recorder and an independent controllable speaker output 194 which can be switched off while recording is in session. Sound card 190 can be a Sound Blaster card of Creative Labs, which provides "line out" and "speaker output" features. However, such sound cards are dependent, meaning that their output amplitudes correlate to one another, and a gain control 184 of amplifier 182 determines the common gain of both outputs 194 and 192. Amplifier 188 amplifies the signal sent to speakers output only and thus power control 188 of amplifier 186 controls its output only. As a result, the present invention provides an independent control of these outputs, by controlling independent gain or alternatively independent control of connection to the outputs, thereby enabling silencing of the speaker output 194 while "line out" 192 is operating.

Fig. 6E illustrates a fifth embodiment of the present invention. A personal audio system 660, such as an audio tape recorder, is assembled in computerized system 600. Portable storage means 200, can be inserted into personal audio system 660 to store or retrieve audio segments. Such an arrangement is easier to use and does not require external wiring, thereby providing a system that is more reliable and takes up less space.

As shown in Fig. 6E, computerized audio system 10 employs computerized system 600 to deliver off-line selected audio segments. That is, computerized system

600 can process the selected audio segments (as described in Fig. 6E) and digitally store them on storage means 662 through the use of recording apparatus 660. Storage means 662 can be a Recordable Mini Disk (MD), a Recordable CD (i.e., an CDR650/74 developed by 3M Corp.),or re-Recordable CD such as Philips CDR870 recorder, Philips Digital Compact Cassette (DCC) or a floppy disk 664. Recording apparatus 660 can respectfully be a MD, CD-RW Re-Writtable recording device (i.e., DVD), floppy disk drive, or flash card, connected to a computerized system 600. Once download of audio segments have been completed, storage means 662 can be removed from recording apparatus 660 and inserted and played on another audio system, such as a car stereo, or a portable Walkman like device. It will be appreciated that using present invention for automatic off-line or on-demand retrieval, customization and storage of text converted to speech, or personal audio selection stored onto storage means such as commonly available Recordable MD or Re-Recordable CD as described in Figs. 7A and 7B will be used as an enhanced productivity tool for people on the go.

Fig. 7A illustrates a flow diagram of an operation of computerized audio system 10. Computerized audio system 10 can be initiated on-demand (Step 770), upon a user request, or automatically (Step 772) as described in more detail in Fig 7B. The user can automatically select and retrieve data, such as documents 774, E-mail 776, news 778 and so forth. Data in text format is converted to speech 780 (e.g., digital speech can be stored on digital storage means such as Recordable MD). If the storage means employs an analog input format the digital

speech is further converted to analog speech signal 790).

The user can also select and retrieve audio formats such as compressed voice 782 or compressed audio 784, which are then decompressed (Step 788). Digital audio can be stored on digital storage means such as Recordable MD (such as Aiwa AM-F5 portable recorder). If the storage means employs an analog input format the digital audio signal is further converted to analog audio signal 790)The user can further select and retrieve voice and audio in wave or analog signal formats 786). Computerized system 600 can be automated to retrieve selected data according to predetermined criteria.

Once the selected data is retrieved, computerized system 600 downloads the selected data as audio segments for storage on portable storage means 200 (Step 790). It should be understood that the audio segments can be stored on portable storage means 200, such as an audio cassette tape, microcassette, Mini Disk (MD), CD-RW, Digital Audio Tape (DAT), DVD, Compact Disk, DCC, Floppy disk Flash memory 790 or equivalent. Any portable memory storage unit can be employed so long as data can be downloaded and replayed at another located.

Fig. 7B is a flow diagram of a typical sequence of operations for storing customized audio on a personal audio system. Computerized system 600 can be configured to begin the downloading and recording process of Fig. 1A (i) at a prespecified time period, i.e., 9:00 am (Step 702) (ii) upon retrieval of the selected data (i.e., receipt of an E-mail) (Step 704), (iii) at the request to

start by a user (Step 706). Once initiated, computerized system 600 selectively retrieves data from external link 610 or internal storage (Step 708), which is processed to extract relevant data according to user's definition of content to be stored (Step 710).

Once the selected data is retrieved, the storage of the selected data is dependent on the type of portable storage means 200. If audio system 100 employs a digital portable storage means 200 (as described in Fig. 2), digital data is reformatted (Step 713) according to storage means (i.e., if data is text it is being converted to digital speech using TTS algorithm, in case MD further processes can be used, such as ATRAC 4.5 data reduction) the selected data is transmitted to audio system 100 as audio segments and stored on digital portable storage means 200 (Step 714). If portable storage means 200 is an analog storage, such as a magnetic tape, or MD with analog input, the selected data is further processed according to the data format. If the selected data is in text format (Step 716), then it is converted to a speech format through the use of Text-To-Speech algorithms performed by computerized system 600 (Step 718). If the selected data is in a compressed format (Step 720), then it is decompressed to audio or voice (Step 722). In the event the selected data is modulated (Step 724), then the audio is demodulated to an audio format (Step 726). Accordingly, the format of the audio segments is dependent on the format of the data and the format employed by portable storage means 200.

In any event, computerized system 600 can also inserts intentional automatic segments of silence between

each audio segment (Step 728) to enable skipping (i.e., SKIP operation) between segments when played on audio system 100, or add codes as required. If the audio segments are stored on a MD through the use of analog recording, each audio segment is stored in different track to allow a user to employ conventional search functions (e.g., the SKIP function) to browse through the audio segments. When the audio segments are being played (Step 730) and downloaded onto portable storage means 200 (Step 732), the external speakers of computerized system 600 can also be switched off or into a MUTE mode to avoid noise.

Fig. 7C provides a flow diagram of an operation for storing selected audio segments on a portable storage means 200 (e.g., an audio cassette) through the use of audio system 100, such as a tape recorder with electronic control (as described in Fig. 2). Initially, audio system 100 detects an insertion of portable storage means 200 therein (Step 760) and then fast rewinds the cassette to the beginning (Step 762). When portable storage means 200 is rewound to the beginning, audio system 100 automatically terminates the rewind operation (Step 764) and awaits the download of the audio segments (Step 766). When the audio segments are ready for download, audio system 100 begins recording the audio segments on portable storage means 200, preferably according to the process shown in Fig. 7B (Step 768). If portable storage means 200 reaches the end before all audio segments are stored, audio system 100 reverses the portable storage means 200 direction to continue downloading of the remaining audio segments on an opposite side. When portable storage means 200 reaches the end of the second

side, the recording process is terminated (Step 770). If portable storage means 200 is not at the beginning, audio system 100 fast rewinds the portable storage means to the beginning (Step 774). Although the above storage method is described for audio cassette tapes, it can be modified to apply to other types of portable storage means 200.

Similarly, if portable storage means 200 is a MD, Computerized system 600 detects if the MD is ready for recording. When the data is ready to be recorded to the MD, computerized system 600 transmits a command to cause audio system 100, in this case a MD player, to start recording each new audio segment on a different track of portable storage means 200. When portable storage means 200 has reached full capacity, computerized system 600 stops recording. Preferably, for the case of E-mail, computerized system will store the E-mail in voice format in a last-in-first-out (LIFO) manner. That is, the most recent E-mail is stored in the first track of portable storage means 200 to be played, and so on accordingly to the order the E-mail was received.

Fig. 7D illustrates a flow diagram of an operation for storing selected data as audio segments through the use of audio system 100, i.e., a tape recorder, with Voice Operated Control (VOX) (as described in Fig. 6A). Initially, portable storage means 200 (i.e., an audio cassette) is inserted into a tape recorder (Step 740). Audio system 100 has a microphone input connected to the audio output of computerized system 600, to receive downloaded audio segments. Portable storage means 200 is rewound to the beginning (Step 744). A user can then manually initiate recording, i.e., by pressing the RECORD

button on audio system 100 (Step 746). Audio system 100 waits to receive the audio segments due to the VOX function. Once computerized system 600 has prepared the selected data as audio segments for download (Step 748), computerized system 600 starts playing the audio segments (Step 750). The VOX of audio system 100 detects the audio segments and begins recording them on portable storage means 200. When portable storage means 200 reaches the end (Step 754), audio system 100 stops the recording operation (Step 758). Throughout this process, computerized system 600 inserts intentional silent segments or the equivalent thereof between each audio segments, which enables a user to later employ the SKIP function when portable storage means 200 is played.

Reference is now made to Figs. 8A, 8B, 8C, 8D and 8E which illustrate an alternative embodiment of implementing the present invention with the use of a modified audio cassette (i.e., portable storage means).

Fig. 7E is a flow diagram of a storage operation of user responses, such as a voice comment, on the same portable storage means 200, in this case a Mini Disk, that stores the audio segments. A user begins by playing the audio, i.e., the audio segments, stored on portable storage means 200 through the use of a personal audio system, such a Mini disk player (Step 910). If there are any audio segments that have not been played, the personal audio system plays them (Step 912). As each audio segment is being played, the user can initiate a RECORD operation to stop the playing of audio segments and to store a user response associated with the most recent or last audio segment (N) being played (Step 918).

At this time, the personal audio system stores an identifier onto a comment or response allocation table (stored on portable storage means 200) that associates the user response with the last audio segment (N) being played. The user can then record a voice message, can mark the audio segment being played for future reference and so forth (Step 920). The user responses are stored on a new track on portable storage means 200. Once the recording operation is completed, the personal audio system resumes playing from the consecutive audio segment (Step 924). When all audio segments have been played, the personal audio system updates the comment allocation table. The personal audio system can compress the user responses while recording or after finishing the playing/recording process (Step 928).

It should be understood, that the personal audio system (i.e., audio system 200) can be detachably connected to computerized system 600 of the present invention. Upon a user request, the personal audio system uploads the comments allocation table, user responses related to audio segments and audio segment identifiers, such as header of E-mail played which contains the address of the sender and subject in text format, to computerized system 600. The feature of the present process is that a user can listen to audio segments, such as E-mail in voice format, record voice comments (e.g., user responses) related to specific E-mail heard, upload the user responses and send them automatically to the destination (e.g., the sender's address).

Fig. 8A illustrates a modified cassette 800 which includes a cassette shell 804, magnetic audio reels 802

with hubs, and a magnetic audio magnetic tape 850 connected between the reels. There is provided cassette control 810 (810a, 810b) located in cassette shell 804 in a manner so as not to disturb audio magnetic tape 850. A cable 812 is connected between cassette control 810 and a control/microphone unit 814. Modified cassette 800 enables a user to store marks (i.e., mark audio segments) or vocal messages thereon. The stored marks or vocal messages can typically be in response to audio segments played from audio magnetic tape 850, such as E-mail replies. Control unit 814 may include a power supply connected to cassette control 810, a key for marking or a record command, or an electronic mark generator which produces a mark code, such as DTMF signal. Control unit 814 may also include a microphone for recording the vocal messages.

Referring to Figs. 8B and 8C, there is shown audio magnetic tape 850 of modified cassette 800 and an internal recording magnetic head 816 (Magnetic head 818 belongs to the tape deck and is shown as a reference only). Audio magnetic tape 850 includes a side A with two tracks of audio (i.e., side A-R and side A-L) and a side B with two tracks of audio (i.e., side B-R and side B-L). Side A can be used to store information described in Fig. 4A, such as a code segment 852, an information segment 854, a silence segment 856. Side B may be employed to store a duplicate copy of information code 862, and a recorded segment 860. Recorded segment 860 can be a recorded voice message or code markings. Segment code 862 and recorded segment 860 can be stored on different tracks 850A, 850B (as shown in Fig. 8C) or on the same track.

In operation, as the audio segments on modified cassette 800 is played on a tape player, a user can initiate an operation to record a mark or a voice message related to a current audio segment being played. The record operation stops the movement of cassette 800. The tape player detects the operation and automatically switched the direction of the tape movement. Internal recording head 816 of cassette 800, located on control board 810A, begins to record voice messages received from external microphone 814 on an inner side of the tape. A magnetic head of the tape player 818 is shifted and, thus, not affected by the voice being recorded. This prevents electric-acoustical feedback while recording the voice messages.

It will be appreciated that a user can use the same audio cassette both for listening to audio information and to store responses thereto. The present invention enables correlation between segments recorded 860 and segments played 854. Although the above example describes a manner of storing both audio segments and user responses on an audio cassette tape, such an arrangement may also be applied to Recordable MD, Recordable CD and so forth using the same principles of the present invention.

Fig. 8D illustrates a block diagram of modified cassette 800. Modified cassette 800 includes RECORD command input means 870, code marking means 874, and a microphone input 872 connected to cassette control 810, via a cable 812. Cassette control 810 receives voice signals from microphone 872 or mark code signal 874,

which is amplified by an amplifier 878. Upon receiving a record command 870, cassette control 810 enables recording 876, by transmitting the amplified signal to a recording magnetic head 816A. Recording magnetic head 816A then records the amplified signals on magnetic tape 850 of modified cassette 800.

A magnetic pick-off head 816B converts a magnetic signal on a magnetic tape 850. The signal is amplified by an amplifier 886. A segment code is detected by a detector means, such as a DTMF detector and enables a routing of the code signals to be recorded on the tape, via amplifier 882 and magnetic head 816A. Upon receiving a record command 870, a change direction control 888 causes the tape player to change the direction of the tape rotation. A direction control 888 can be a mechanical break, such as a solenoid that stops the rotation of the tape hubs by friction momentarily and causes the direction change of the tape player. Side B (850A, 850B) of the tape is now recording the segment code, user mark or user vocal message. Once recording is completed, recording direction control 888 changes the rotation direction again and the tape player continues playing the audio segments on side A.

Fig. 8E illustrates another embodiment of modified cassette 800 which incorporates a separate digital memory device to store voice messages, marks, etc. Modified cassette 800 includes a digital storage means 894, such as a solid state memory, for storing vocal messages, marks made by the user, and optionally recording a code identifying the audio segment being played, while a user records a message. A controller 892 receives a user

record commands 876 and enables amplifier 878 to amplify the users voice or marks which is then converted to digital data using a CODEC 896, such as 3054 of National Semiconductors. The digital data is then compressed by controller 892 and stored on solid state memory 894, such as FLASH memory of Intel Corporation. In the alternative, an MD system can include Solid state memory for recording short audio segments, such as voice notes.

The present invention having thus been described with particular reference to the preferred forms thereof, it will be obvious that various changes and modifications may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

CLAIMS

1. A computerized audio system for converting text to audio segments on a portable storage means, said computerized system comprising:

means for accessing digital data representative of said text;

means for storing said audio segments on said portable storage means; and

processing means coupled to said accessing means for retrieving from said means portions of said digital data, said processing means further including means for converting said portions of said digital data to a signal form that is recordable as audio and causing said means for storing to store said signal form on said portable storage means as audio segments.

2. The system as recited in claim 1, wherein said processing means selectively retrieves said portions of said digital data based on user entered criteria.

3. The system as recited in claim 1, wherein said processing means converts said portions of said digital data to an analog signal for storage on said portable storage means as said audio segments.

4. The system as recited in claim 1, wherein said processing means converts said portions of said digital data to a digital format for storage on said portable storage means as said audio segments.

5. The system as recited in claim 1, wherein said text is one of the group consisting of electronic mail, textual documents and html page data.

6. The system as recited in claim 1, wherein said means for storing stores said audio segments on said portable storage means at a faster rate than a playing rate.

7. The system as recited in claim 1, wherein said means for storing is a magnetic tape recorder.

8. The system as recited in claim 1, wherein said processing means stores audio segments on said portable storage means in a manner to respond to a search function of a portable storage means player

9. The system as recited in claim 1, wherein said processing means produces silence segments on said portable storage means between each of said audio segments.

10. The system as recited in claim 1, wherein said means for storing is a voice activated audio tape recorder so as to enable an automatic storage operation of said signal form on said portable storage means without user intervention.

11. The system as recited in claim 10, wherein said voice activated audio tape recorder includes a magnetic head, said processing means generating a signal that is detectable by said voice activated audio tape recorder to enable said storing operation to continue even though any

signal recording during transmission of said signal will be considered as a silence segment by a tape player.

12. The system as recited in claim 11, wherein said processing means selectively generates said signal to produce said silence segment on said portable storage means between each of said audio segments.

13. The system as recited in claim 1, wherein said means for storing is detachably connected to said processing means.

14. The system as recited in claim 1, wherein said portable storage means includes:

first memory means for storing said audio segments;

input means for receiving user responses to said audio segments;

second memory means, connected to said input means, for storing said user responses; and

second processing means for storing said user responses from said input means on said second memory means.

15. The system as recited in claim 14, wherein said first memory means is at least a magnetic tape.

16. The system as recited in claim 14, wherein said second memory means is connectable to said processing means to download said user responses from said second memory means to said processing means.

17. The system as recited in claim 1, wherein said portable storage means includes a first recording section and a second recording section, said means for storing said audio segments on said first recording section and user responses to said audio segments on said second recording section.

18. The system as recited in claim 1, wherein said processing means stores a code segment on said portable storage means.

19. The system as recited in claim 18, wherein said code segment is an identification code to identify each of said audio segments.

20. The system as recited in claim 18, wherein said code segment is a security code that is written on said portable storage means that at least identifies at least one authorized receiver.

21. The system as recited in claim 1, further comprising speaker means, said processing means having means for muting said speaker means during storage of said audio segments on said portable storage means.

22. The system as recited in claim 1, wherein said processing means further includes means for storing a number of times each of said audio segments has been recorded.

23. The system as recited in claim 22, further comprising means for generating a signal and means for

transmitting said signal if said number of times of one of said audio segments exceeds a predetermined number.

24. The system as recited in claim 22, wherein said processing means disables further duplication of one of said audio segments if said number of times of one of said audio segments exceeds a predetermined number.

25. The system as recited in claim 1, wherein said processing means includes means for determining whether said portable storage means has reached full capacity.

26. The system as recited in claim 25, wherein said processing means causes remaining audio segments unable to be stored on said portable storage means to be stored onto an alternate portable storage means.

27. The system as recited in claim 25, wherein said portable storage means has a first side and a second side, said processing means causes remaining audio segments unable to be stored on said first side to be stored on said second side.

28. The system as recited in claim 1, wherein said portable storage means is a recordable mini disk.

29. The system as recited in claim 1, wherein said portable storage means is an audio cassette tape.

30. The system as recited in claim 1, wherein said portable storage means is a recordable compact disc.

31. A computerized audio system for downloading data as audio segments to a portable storage means, said computerized system comprising:

communication means for receiving data, across a network;

means for storing said audio segments on said portable storage means; and

processing means coupled to said communication means for selectively retrieving data across said network, said processing means further including means for converting said selected data to analog signals and causing said means for storing to store said analog signals on said portable storage means as audio segments.

32. The system as recited in claim 31, wherein said processing means stores audio segments on said portable storage means in a manner to respond to a search function of a portable storage means player

33. The system as recited in claim 31, wherein said processing means produces silence segments on said portable storage means between each of said audio segments.

34. The system as recited in claim 31, wherein said means for storing is a voice activated audio tape recorder so as to enable an automatic storage operation of said signal form on said portable storage means without user intervention.

35. The system as recited in claim 34 wherein said voice activated audio tape recorder includes a magnetic head, said processing means generating a signal that is detectable by said voice activated audio tape recorder to enable said storing operation to continue even though any signal recording during transmission of said signal will be considered as a silence segment by a tape player.

36. The system as recited in claim 35, wherein said processing means selectively generates said signal to produce said silence segment on said portable storage means between each of said audio segments.

37. A method for automatically recording selected data as audio segments on a portable storage means, said method comprising the steps of:

selectively retrieving data across a network or from local storage;

converting said selected data to analog signals; and

storing said analog signals on said portable storage means as audio segments.

38. The method as recited in claim 37, wherein said step of converting further converts said selected data related to text to a signal form that is recordable as audio.

39. The method as recited in claim 37, wherein said step of storing stores audio segments on said portable storage means in a manner to respond to a search function of a portable storage means player.

40. The method as recited in claim 37, wherein said step of storing further produces a silence segment on said portable storage means between each of said audio segments.

41. The method as recited in claim 37, wherein said analog signals is stored on said portable storage means through the use of a voice activated audio tape cassette recorder having a magnetic head, said step of storing further including the step of generating a signal that is detectable by said voice activated audio tape recorder to enable said storing operation to continue even though any signal recording during transmission of said signal will be considered as a silence segment by a tape player.

42. The system as recited in claim 41, wherein said step of storing selectively generates said signal to produce said silence segment on said portable storage means between each of said audio segments.

43. A portable special cassette playable on a cassette player comprising:

first memory means for storing audio segments that are played by said cassette player;

input means for receiving user responses to said audio segments;

second memory means, connected to said input means, for storing said user responses; and

processing means for storing said user responses from said input means on said second memory means.

44. The cassette as recited in claim 43, wherein said first memory means is a magnetic tape.

45. The cassette as recited in claim 43, wherein said second memory means is a digital storage device.

46. The cassette as recited in claim 43, wherein said input means is connectable to a microphone.

47. The cassette as recited in claim 43, further comprising interface means for interconnecting to said second memory means to download said user responses.

48. A personal remotely controlled audio system for playing a portable storage means having stored thereon said audio segments of claim 1, said audio system comprising:

means for playing said audio segments on said portable storage means; and

means for remotely operating said means for playing to at least play said audio segments.

49. The audio system of claim 48, wherein said means for remotely operating causes said means for playing to perform a search function, including at least skipping between said audio segments.

50. The audio system as recited in claim 48, wherein said portable means is a cassette player.

51. The audio system as recited in claim 48, wherein said portable means is a Mini Disk.

52. The audio system as recited in claim 48, wherein said means for remotely operating controls wirelessly controls said means for playing

53. The system as recited in claim 28, wherein said portable storage means stores user comments along with an identifier to associate said user comments to an audio segment of said audio segments being played prior to recording said user comments.

54. The system as recited in claim 53, wherein said stored user responses and each said identifier can be uploaded to said processing means.

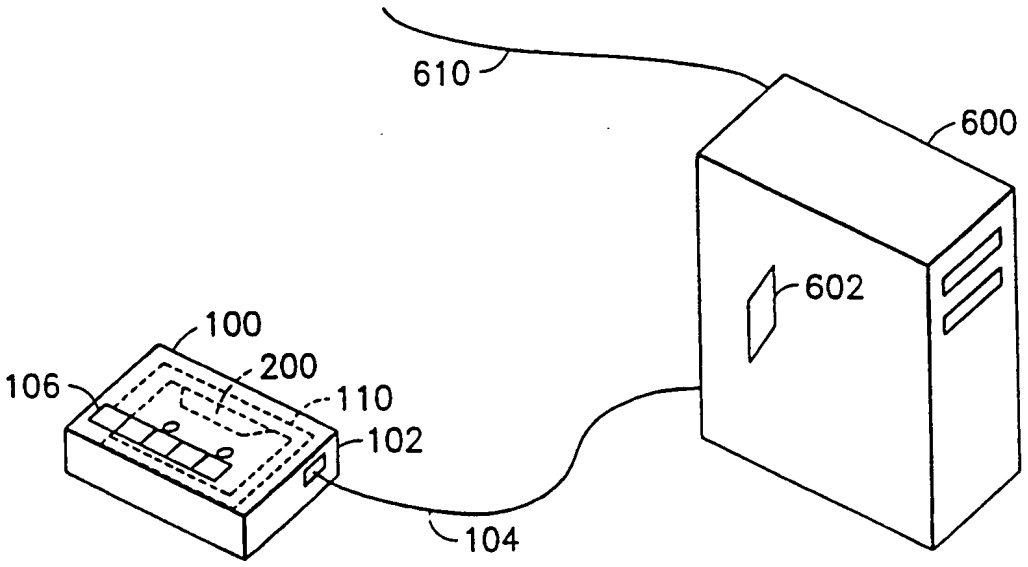

FIG.1A

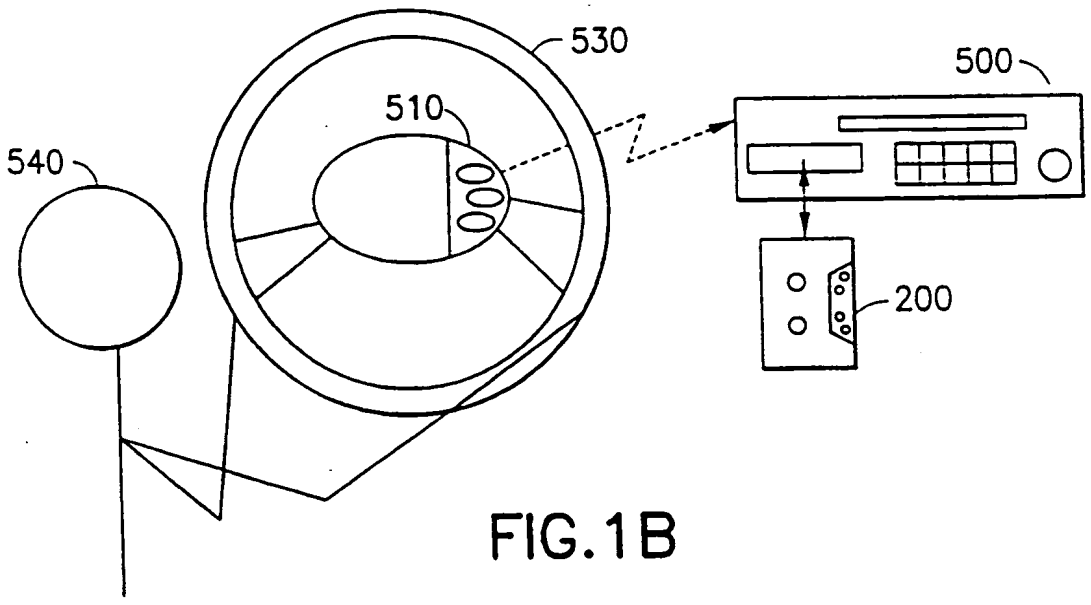

FIG.1B

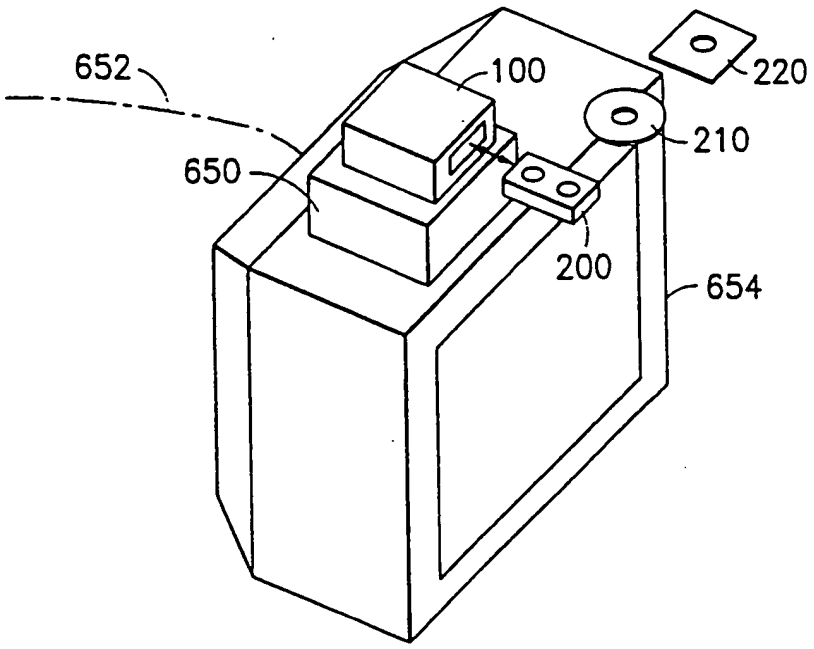

FIG.1C

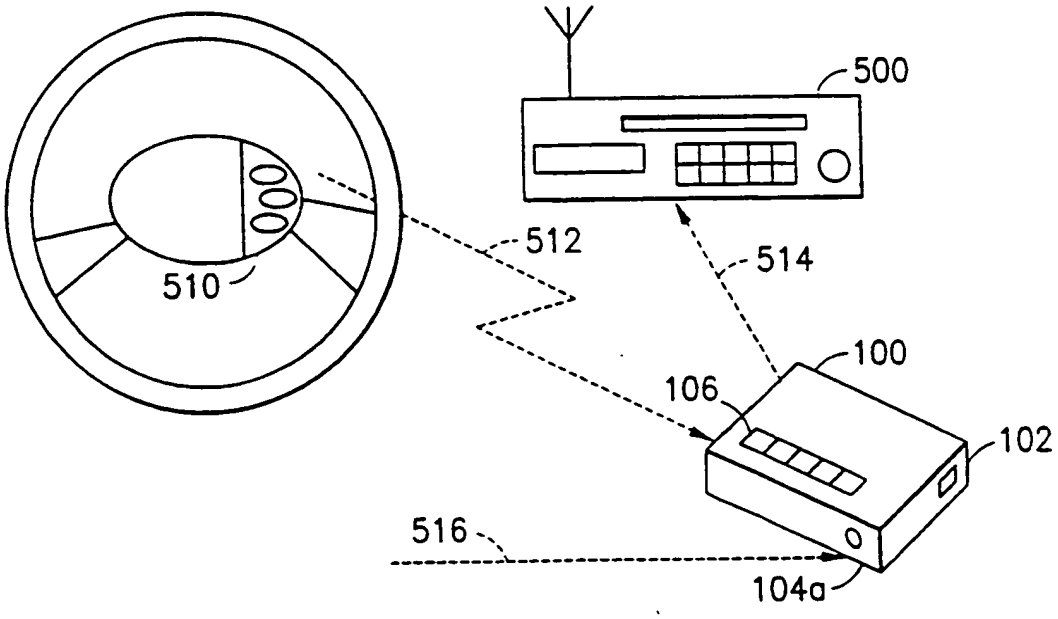

FIG.1D

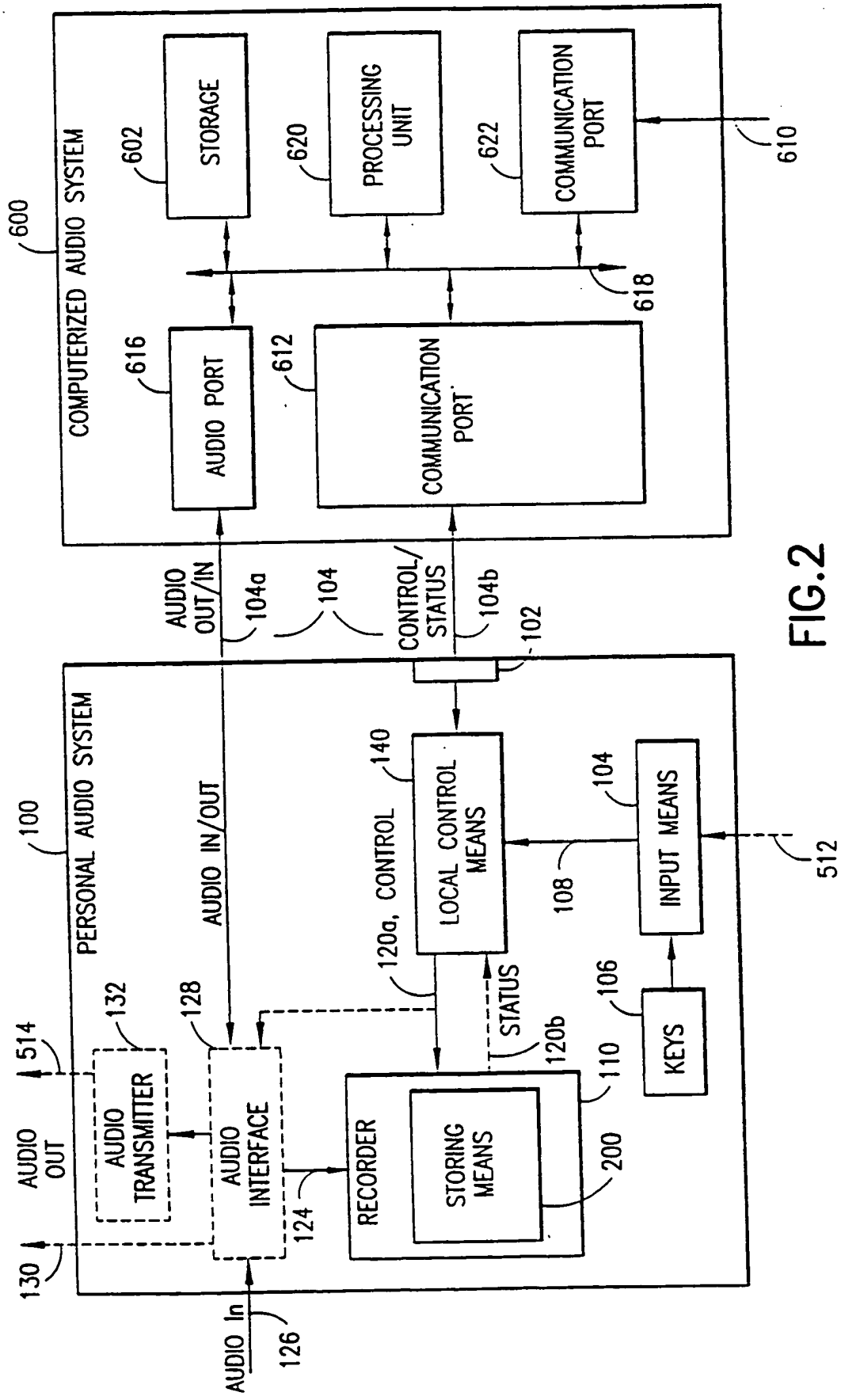
COMPUTERIZED AUDIO SYSTEM
600
STORAGE
602
PROCESSING UNIT
620
COMMUNICATION PORT
622
610
618
AUDIO PORT
616
COMMUNICATION PORT
612
AUDIO OUT/IN
104a
104
CONTROL/ STATUS
104b
102
PERSONAL AUDIO SYSTEM
100
AUDIO IN/OUT
LOCAL CONTROL MEANS
140
120a, CONTROL
INPUT MEANS
104
108
512
STATUS
120b
KEYS
106
110
RECORDER
STORING MEANS
200
AUDIO TRANSMITTER
132
514
AUDIO INTERFACE
128
124
AUDIO OUT
130
AUDIO In
126

FIG.2

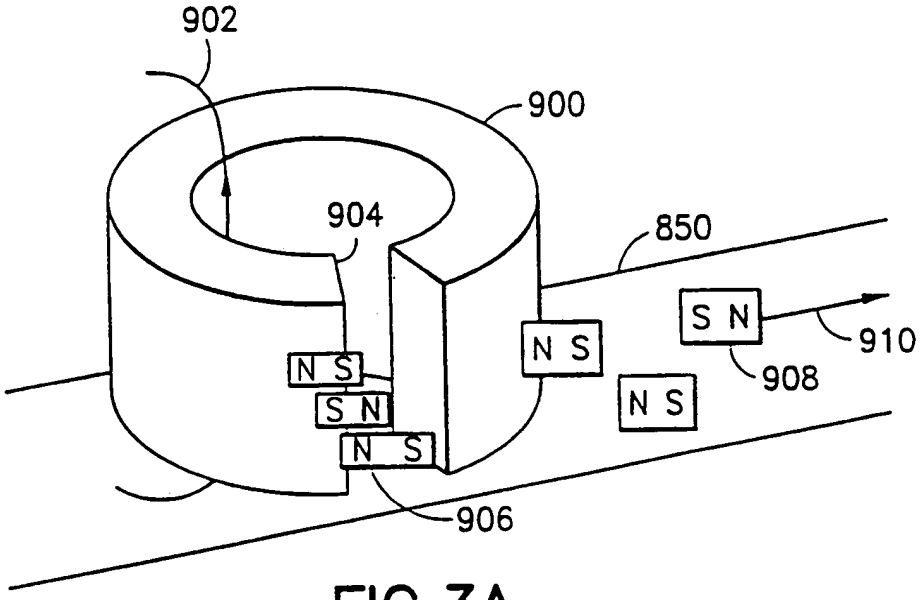
902
900
904
850
N S
S N
N S
S N
N S
N S
S N
910
908
906

FIG.3A

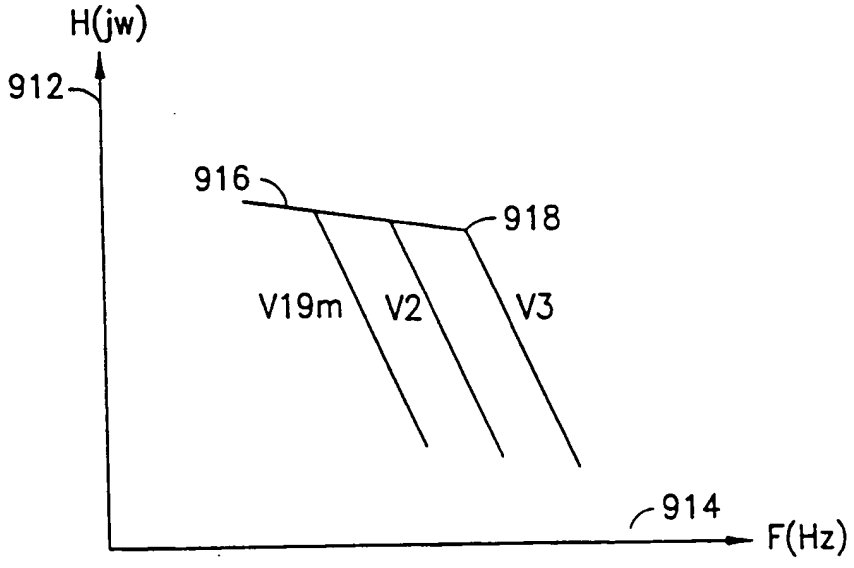
H(jw)
912
916
918
V19m
V2
V3
914
F(Hz)

FIG.3B

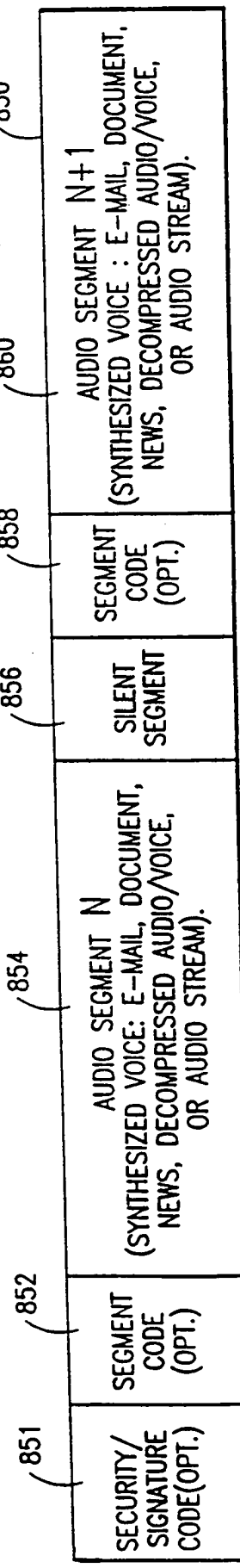
851
SECURITY/ SIGNATURE CODE(OPT.)
852
SEGMENT CODE (OPT.)
854
AUDIO SEGMENT N (SYNTHESIZED VOICE: E-MAIL, DOCUMENT, NEWS, DECOMPRESSED AUDIO/VOICE, OR AUDIO STREAM).
856
SILENT SEGMENT
858
SEGMENT CODE (OPT.)
860
AUDIO SEGMENT N+1 (SYNTHESIZED VOICE : E-MAIL, DOCUMENT, NEWS, DECOMPRESSED AUDIO/VOICE, OR AUDIO STREAM).
850

FIG.4A

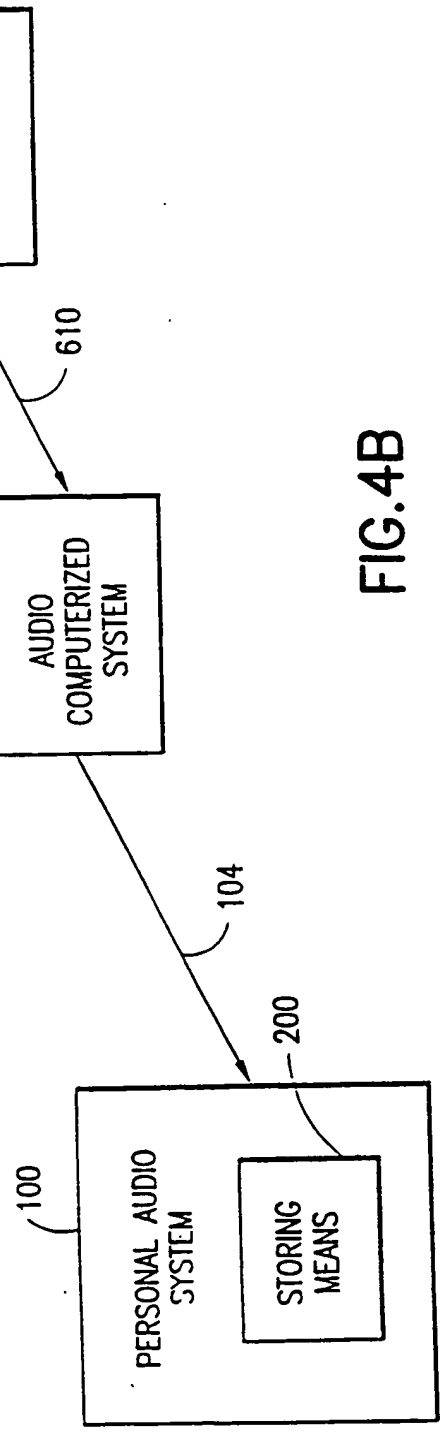
740
CONTENT SERVER
610
600
AUDIO COMPUTERIZED SYSTEM
104
200
100
PERSONAL AUDIO SYSTEM
STORING MEANS

FIG.4B

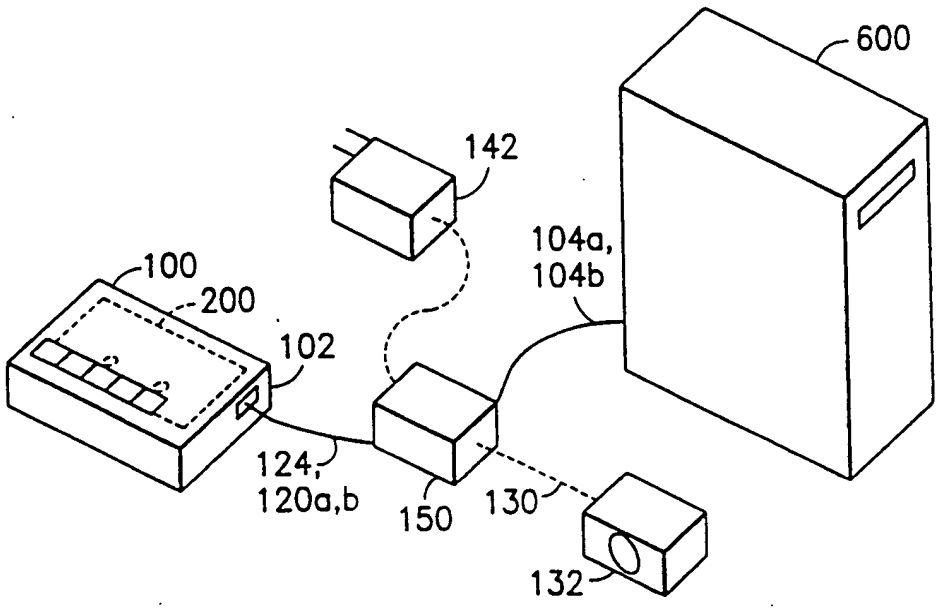
600
142
104a,
104b
100
200
102
124,
120a,b
150
130
132

FIG.5A

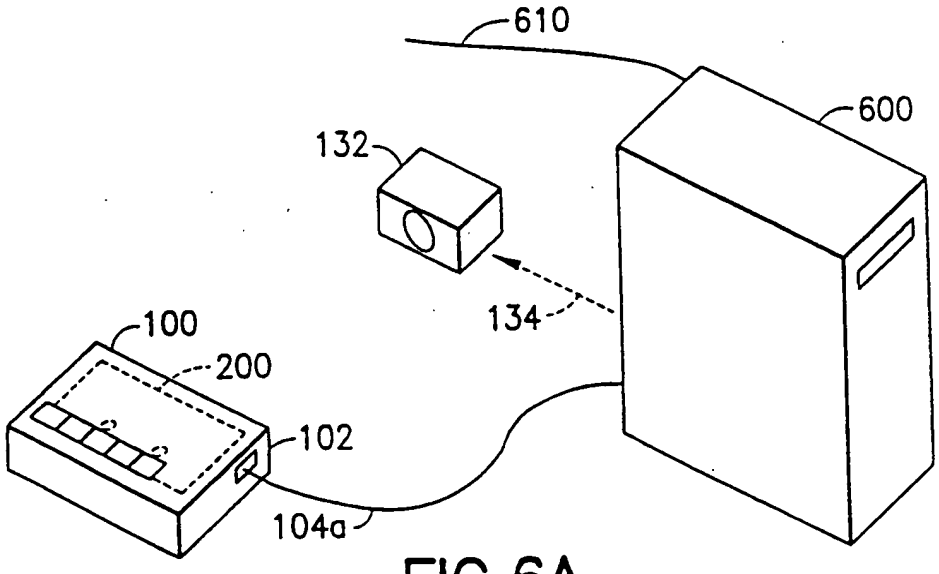
610
600
132
134
100
200
102
104a

FIG.6A

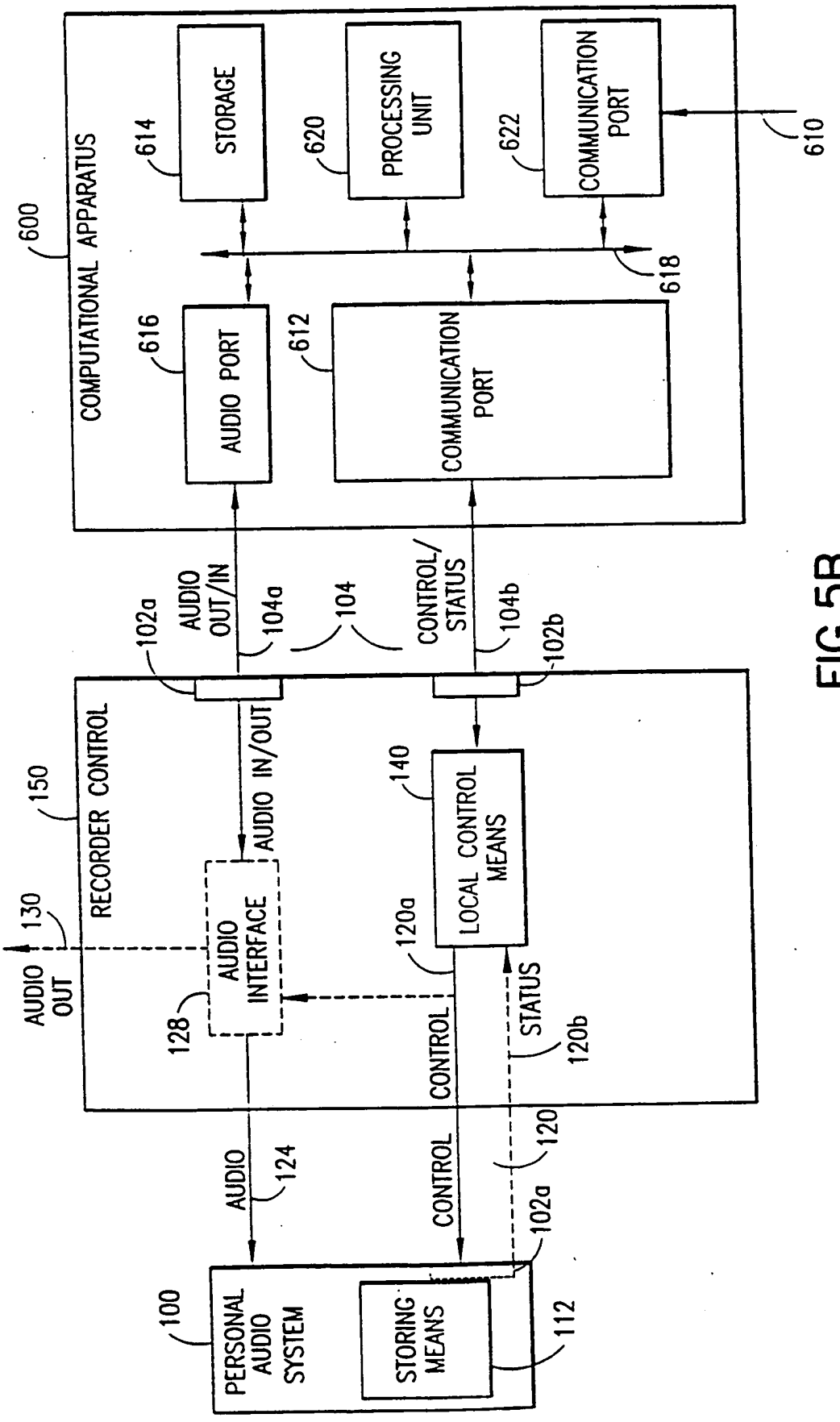
COMPUTATIONAL APPARATUS
600
STORAGE
614
PROCESSING UNIT
620
COMMUNICATION PORT
622
610
618
AUDIO PORT
616
COMMUNICATION PORT
612
AUDIO OUT/IN
102a
104a
104
CONTROL/ STATUS
104b
102b
RECORDER CONTROL
150
AUDIO IN/OUT
LOCAL CONTROL MEANS
140
AUDIO OUT
130
AUDIO INTERFACE
128
120a
STATUS
120b
CONTROL
AUDIO
124
CONTROL
120
102a
PERSONAL AUDIO SYSTEM
100
STORING MEANS
112

FIG.5B

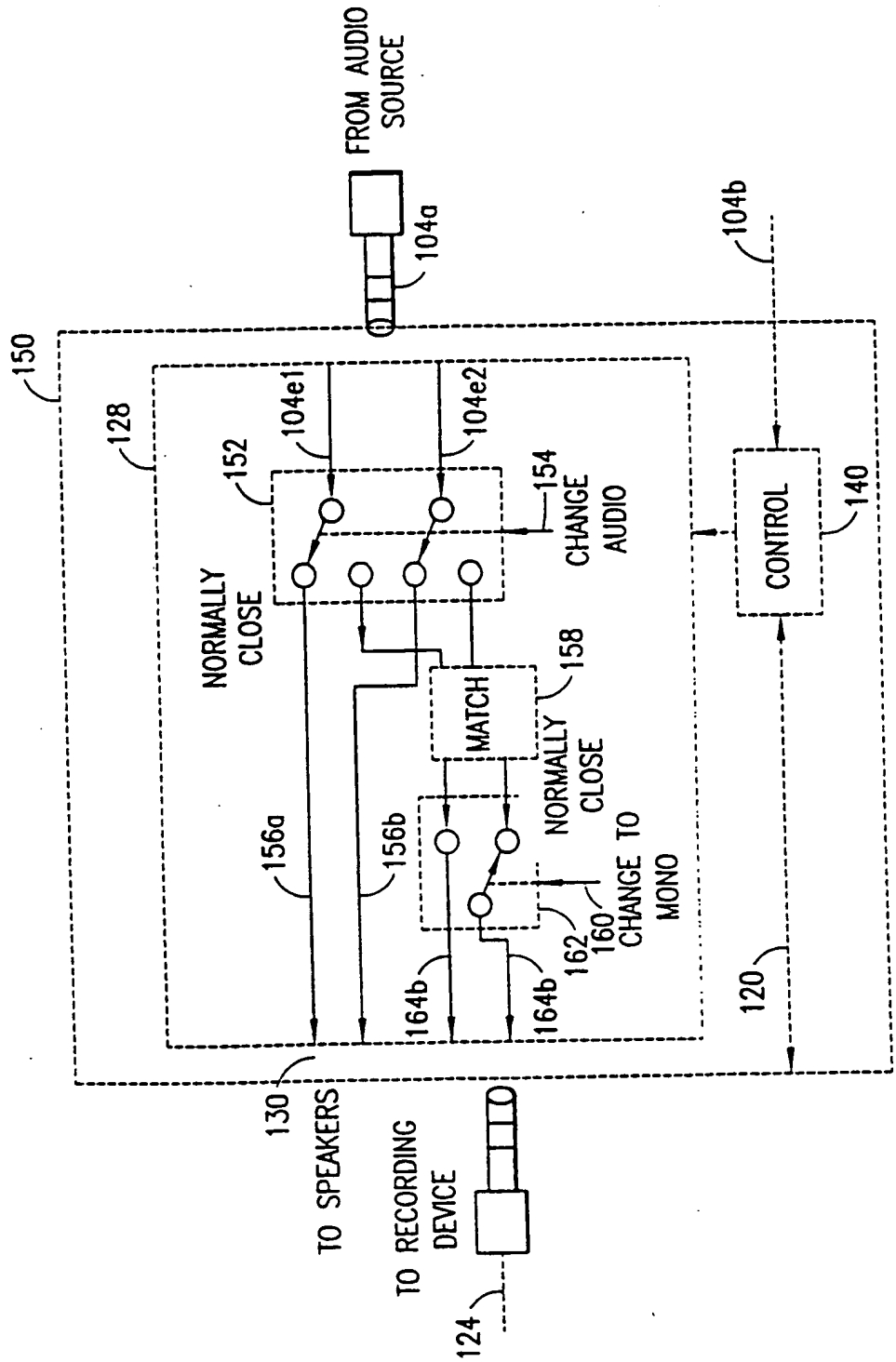
FROM AUDIO SOURCE
104a
104b
150
128
104e1
104e2
152
154
CHANGE AUDIO
NORMALLY CLOSE
CONTROL
140
158
MATCH
NORMALLY CLOSE
156a
156b
CHANGE TO MONO
160
162
164b
164b
120
130
TO SPEAKERS
TO RECORDING DEVICE
124

FIG.5C

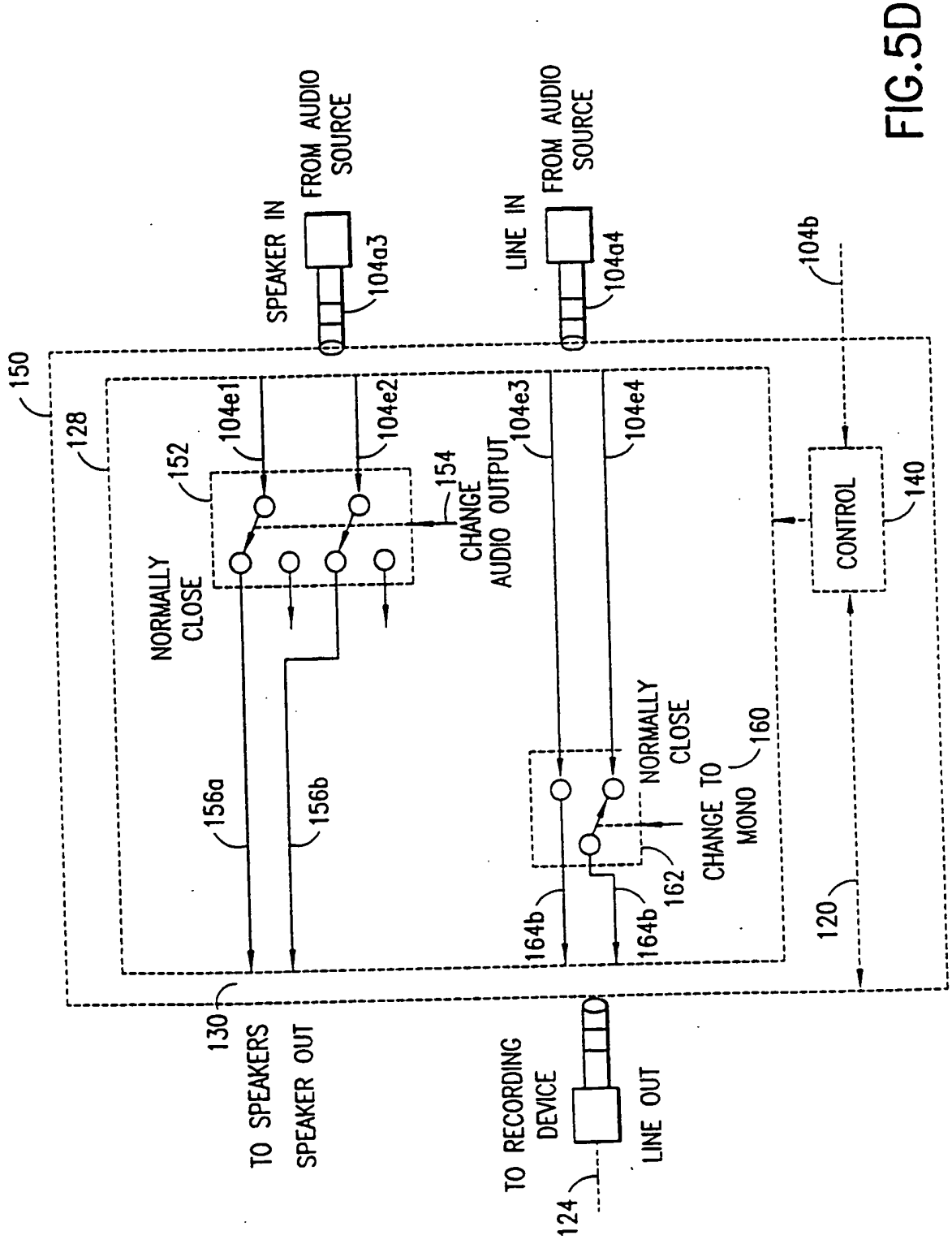
150
128
SPEAKER IN
FROM AUDIO SOURCE
104a3
LINE IN
FROM AUDIO SOURCE
104a4
104b
104e1
104e2
104e3
104e4
152
154
NORMALLY CLOSE
CHANGE AUDIO OUTPUT
CONTROL
140
156a
156b
NORMALLY CLOSE
160
CHANGE TO MONO
162
164b
164b
120
130
TO SPEAKERS
SPEAKER OUT
TO RECORDING DEVICE
LINE OUT
124

FIG.5D

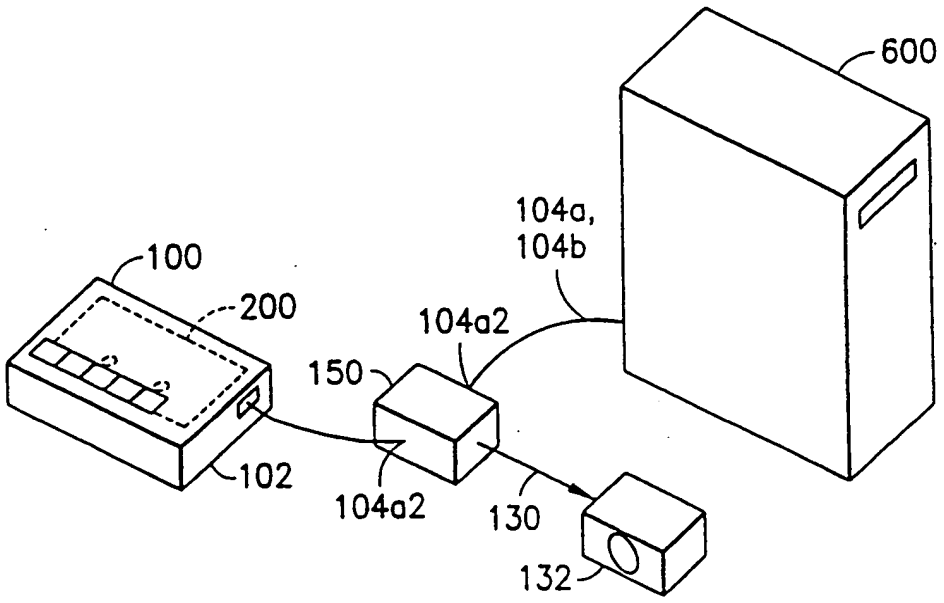
600
104a,
104b
100
200
104a2
150
102
104a2
130
132

FIG.6B

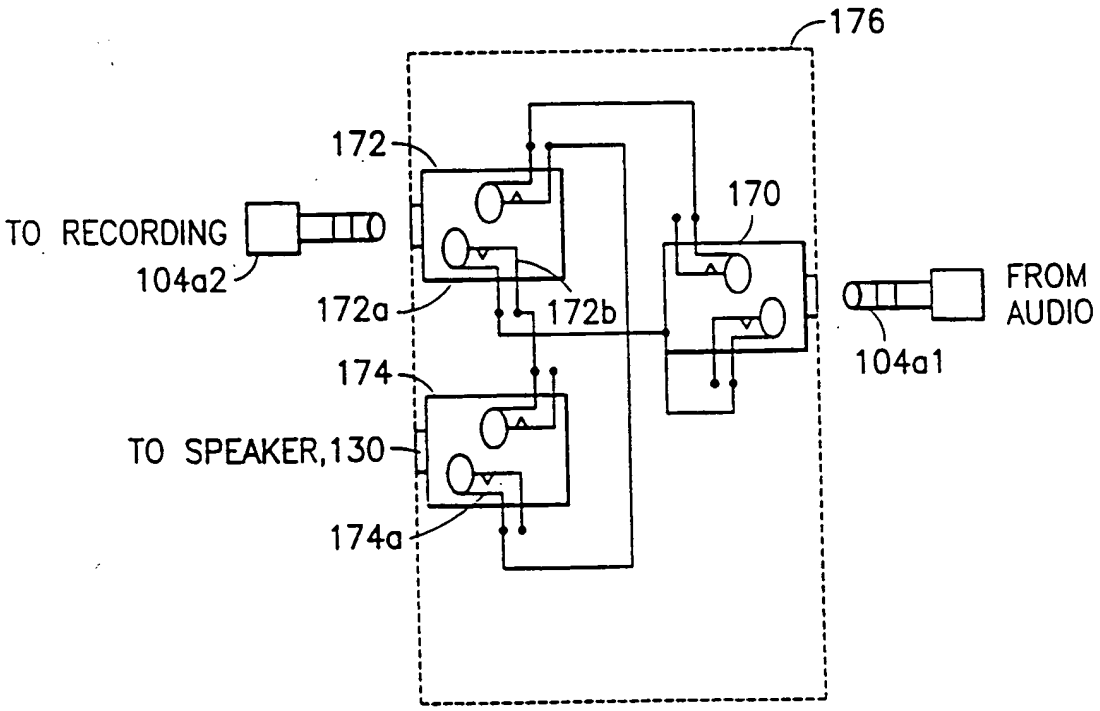
176
172
170
TO RECORDING
104a2
172a
172b
FROM
AUDIO
104a1
174
TO SPEAKER,130
174a

FIG.6C

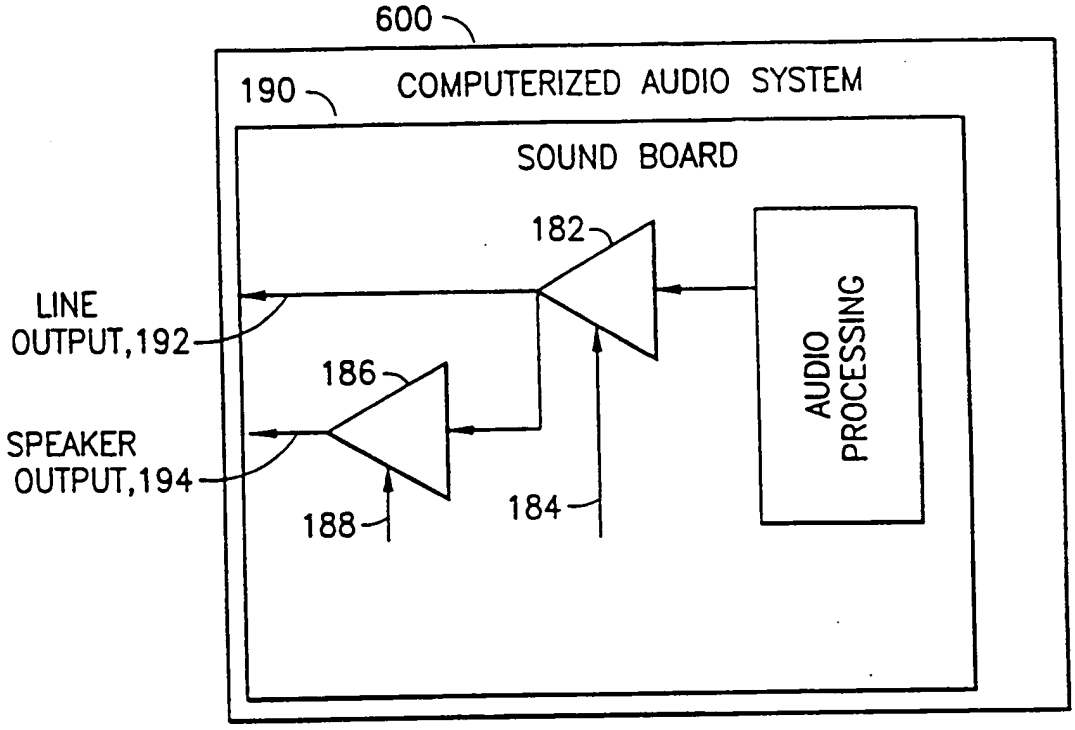
600
190
COMPUTERIZED AUDIO SYSTEM
SOUND BOARD
182
AUDIO PROCESSING
LINE OUTPUT,192
186
SPEAKER OUTPUT,194
188
184

FIG.6D

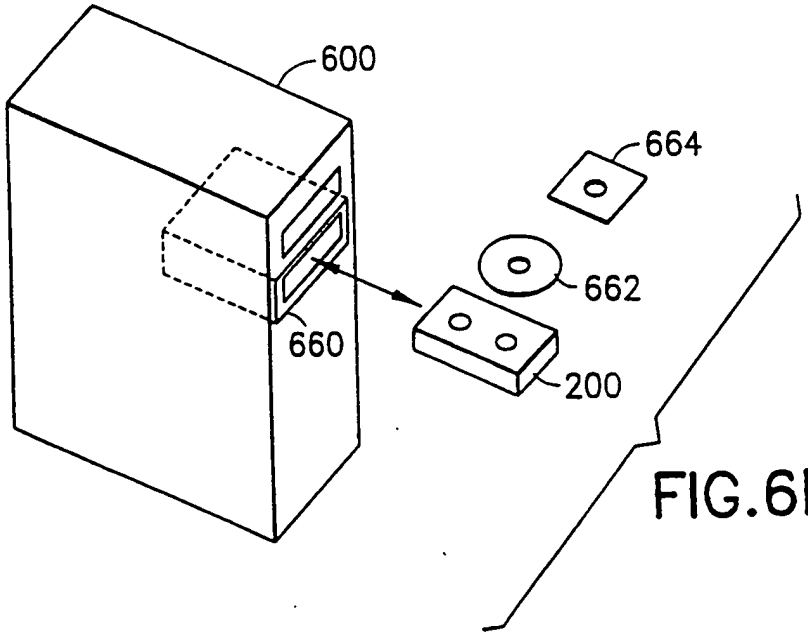
600
664
662
660
200

FIG.6E

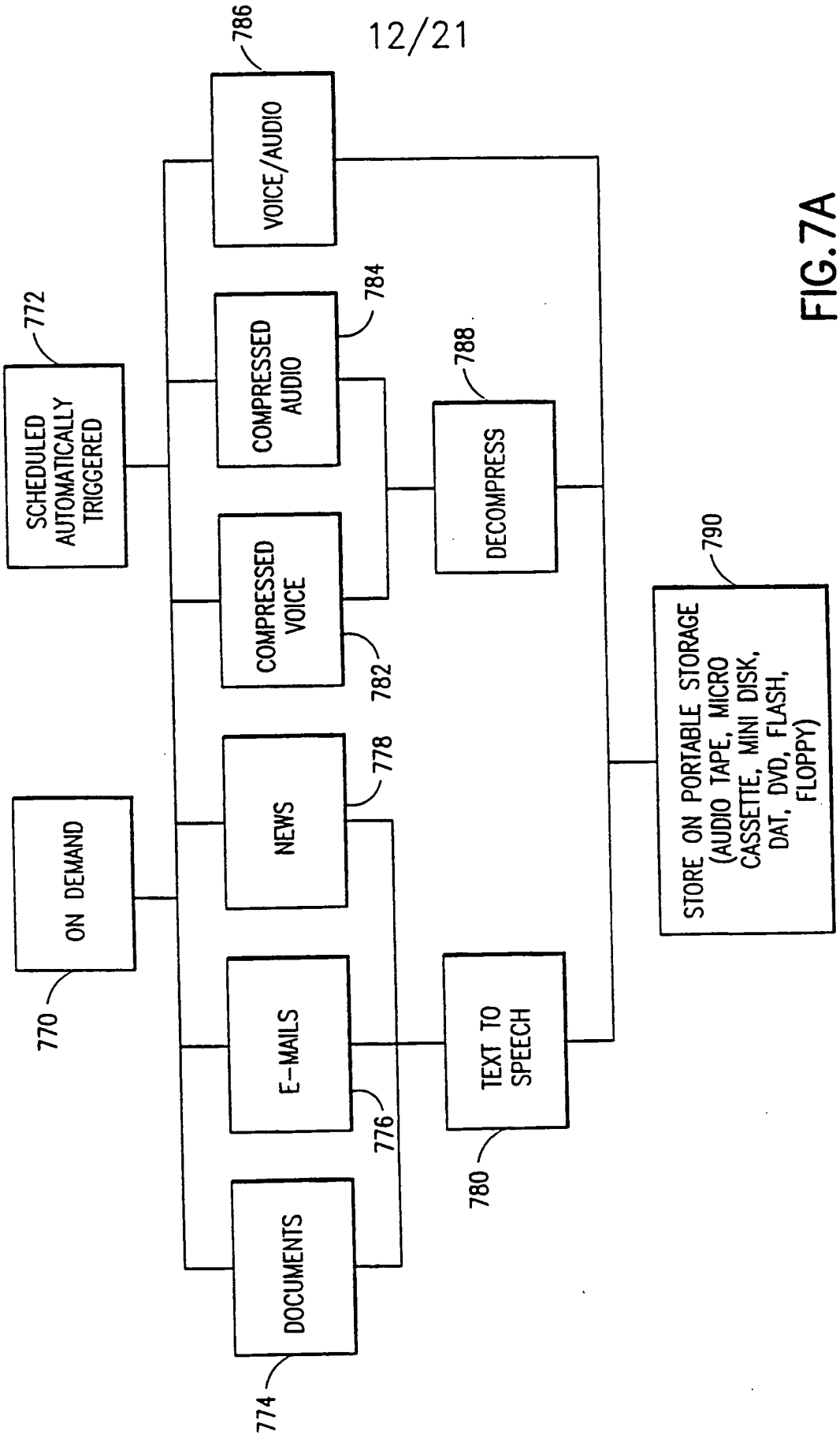
786
VOICE/AUDIO
772
SCHEDULED AUTOMATICALLY TRIGGERED
COMPRESSED AUDIO
784
788
DECOMPRESS
COMPRESSED VOICE
782
790
STORE ON PORTABLE STORAGE (AUDIO TAPE, MICRO CASSETTE, MINI DISK, DAT, DVD, FLASH, FLOPPY)
ON DEMAND
770
NEWS
778
E-MAILS
776
TEXT TO SPEECH
780
DOCUMENTS
774

FIG.7A

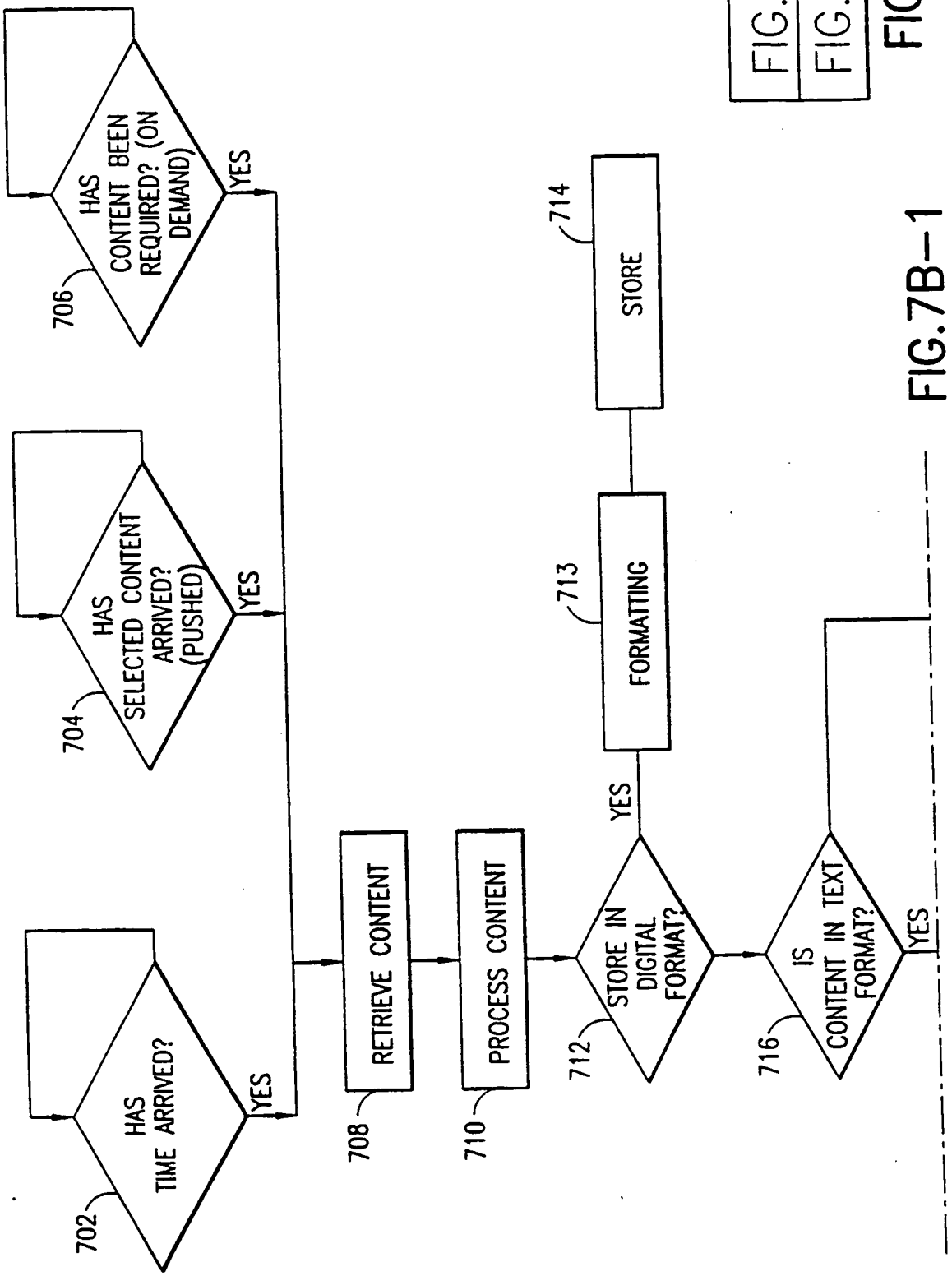

FIG.7B

FIG.7B–1
FIG.7B–2

FIG.7B–1

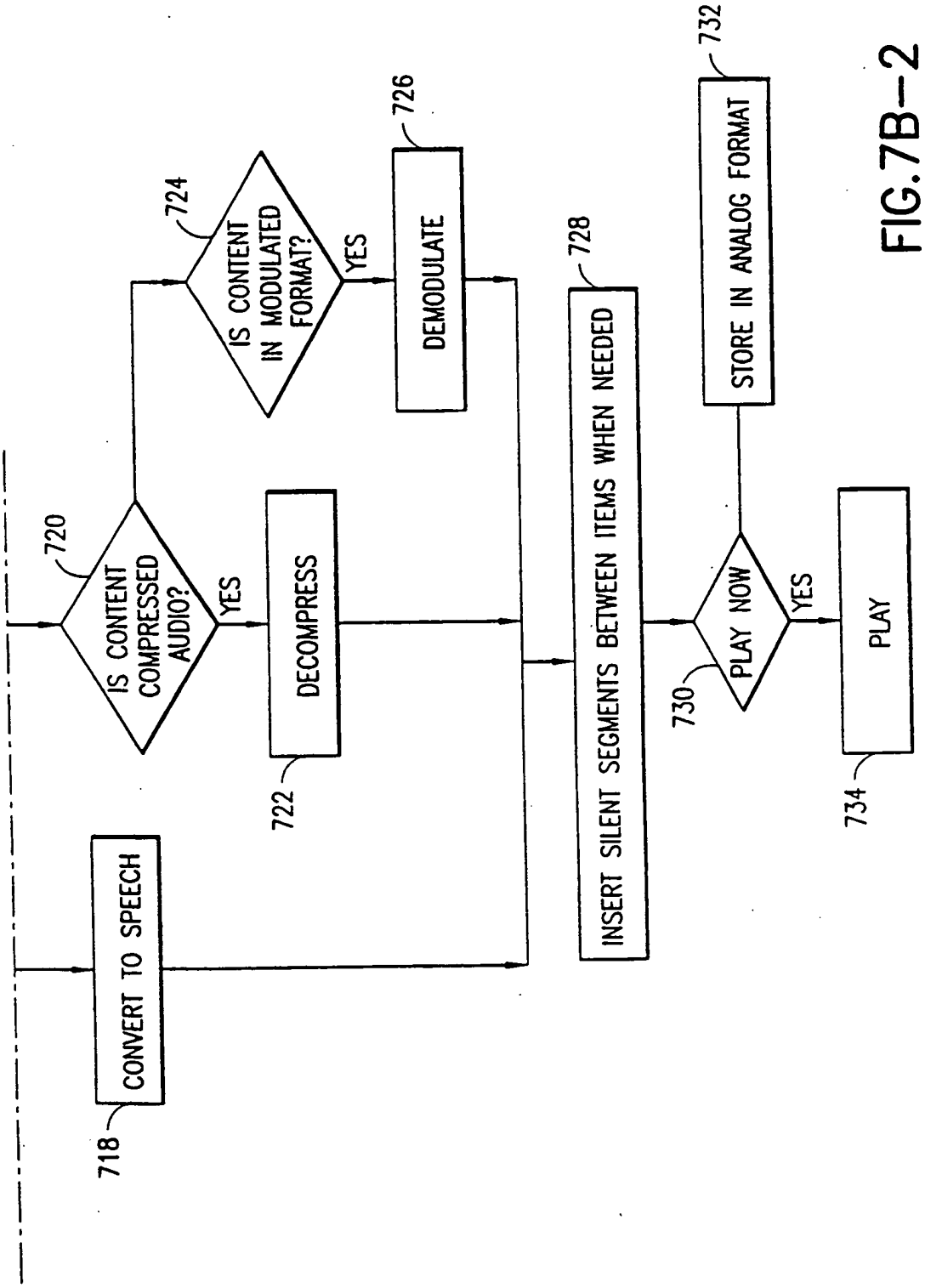
718
CONVERT TO SPEECH
720
IS CONTENT COMPRESSED AUDIO?
YES
722
DECOMPRESS
724
IS CONTENT IN MODULATED FORMAT?
YES
726
DEMODULATE
728
INSERT SILENT SEGMENTS BETWEEN ITEMS WHEN NEEDED
730
PLAY NOW
YES
732
STORE IN ANALOG FORMAT
734
PLAY

FIG.7B-2

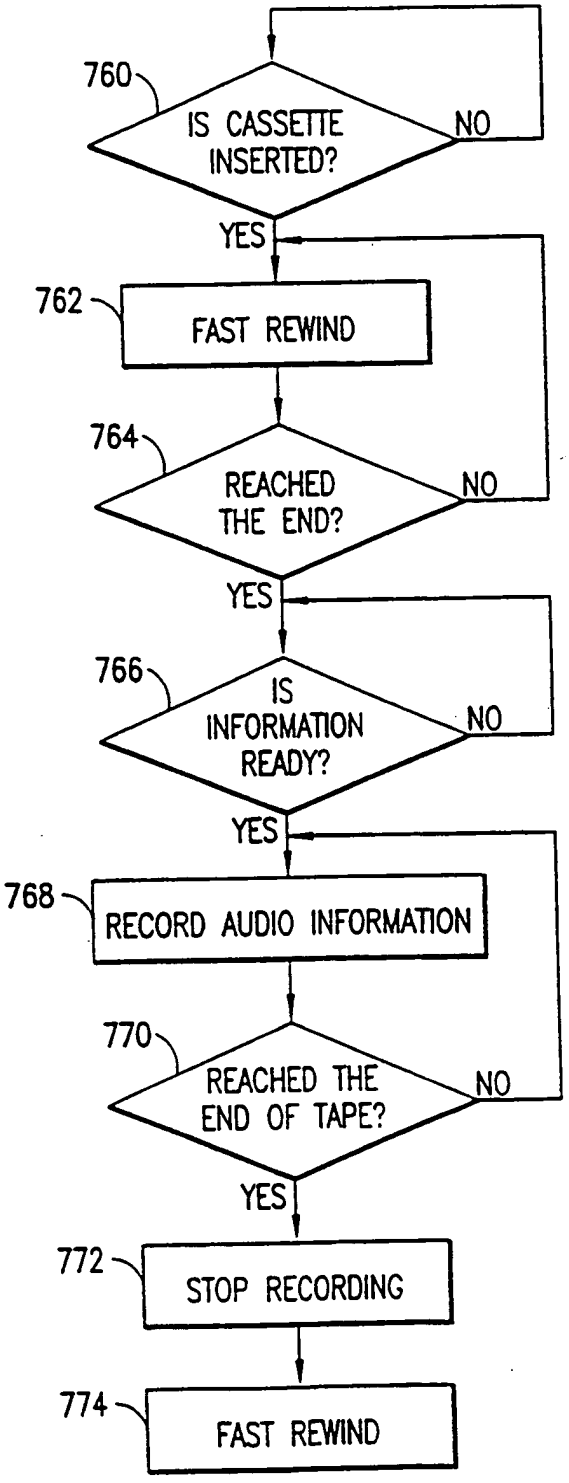
760
IS CASSETTE INSERTED?
NO
YES
762
FAST REWIND
764
REACHED THE END?
NO
YES
766
IS INFORMATION READY?
NO
YES
768
RECORD AUDIO INFORMATION
770
REACHED THE END OF TAPE?
NO
YES
772
STOP RECORDING
774
FAST REWIND

FIG.7C

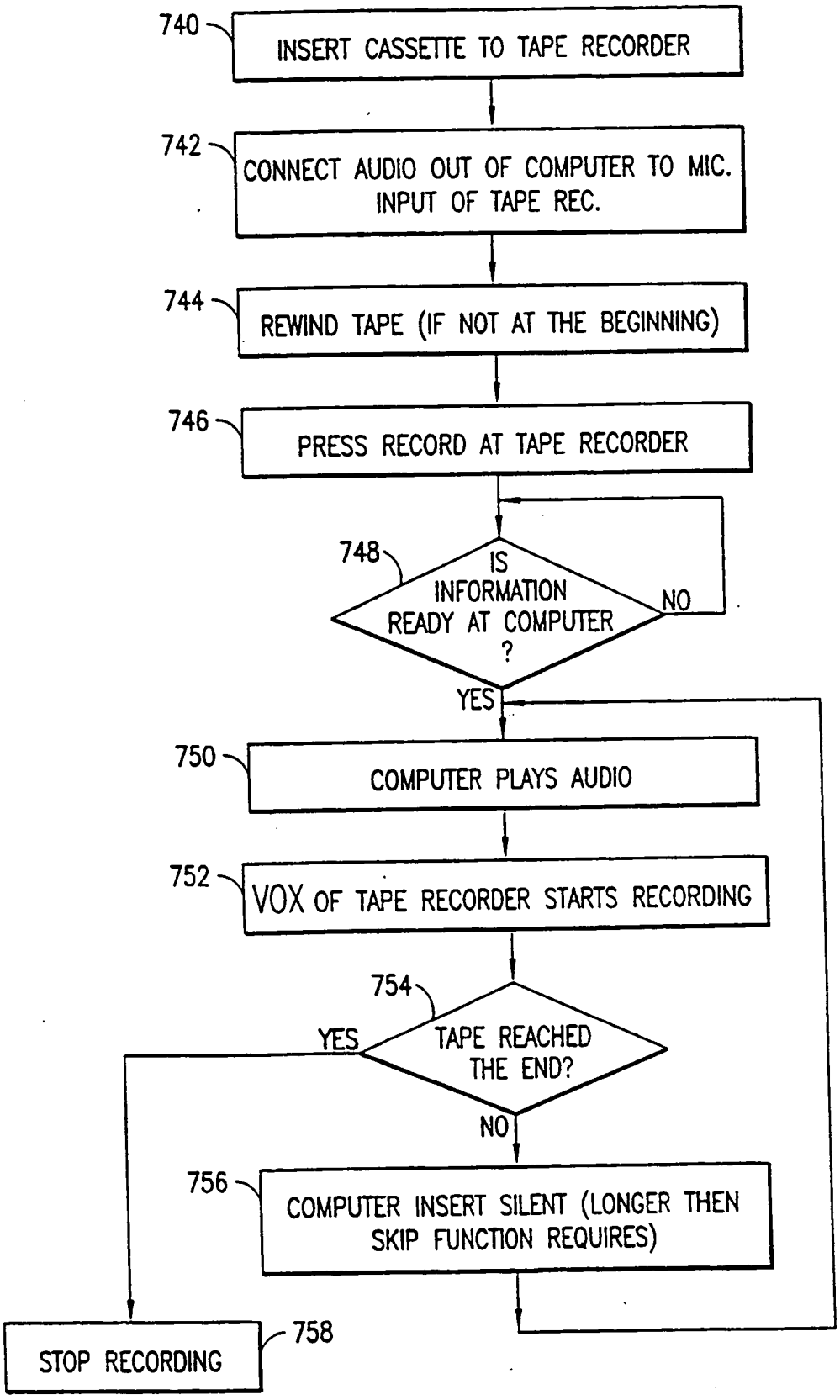
740
INSERT CASSETTE TO TAPE RECORDER
742
CONNECT AUDIO OUT OF COMPUTER TO MIC. INPUT OF TAPE REC.
744
REWIND TAPE (IF NOT AT THE BEGINNING)
746
PRESS RECORD AT TAPE RECORDER
748
IS INFORMATION READY AT COMPUTER ?
NO
YES
750
COMPUTER PLAYS AUDIO
752
VOX OF TAPE RECORDER STARTS RECORDING
754
TAPE REACHED THE END?
YES
NO
756
COMPUTER INSERT SILENT (LONGER THEN SKIP FUNCTION REQUIRES)
STOP RECORDING
758

FIG.7D

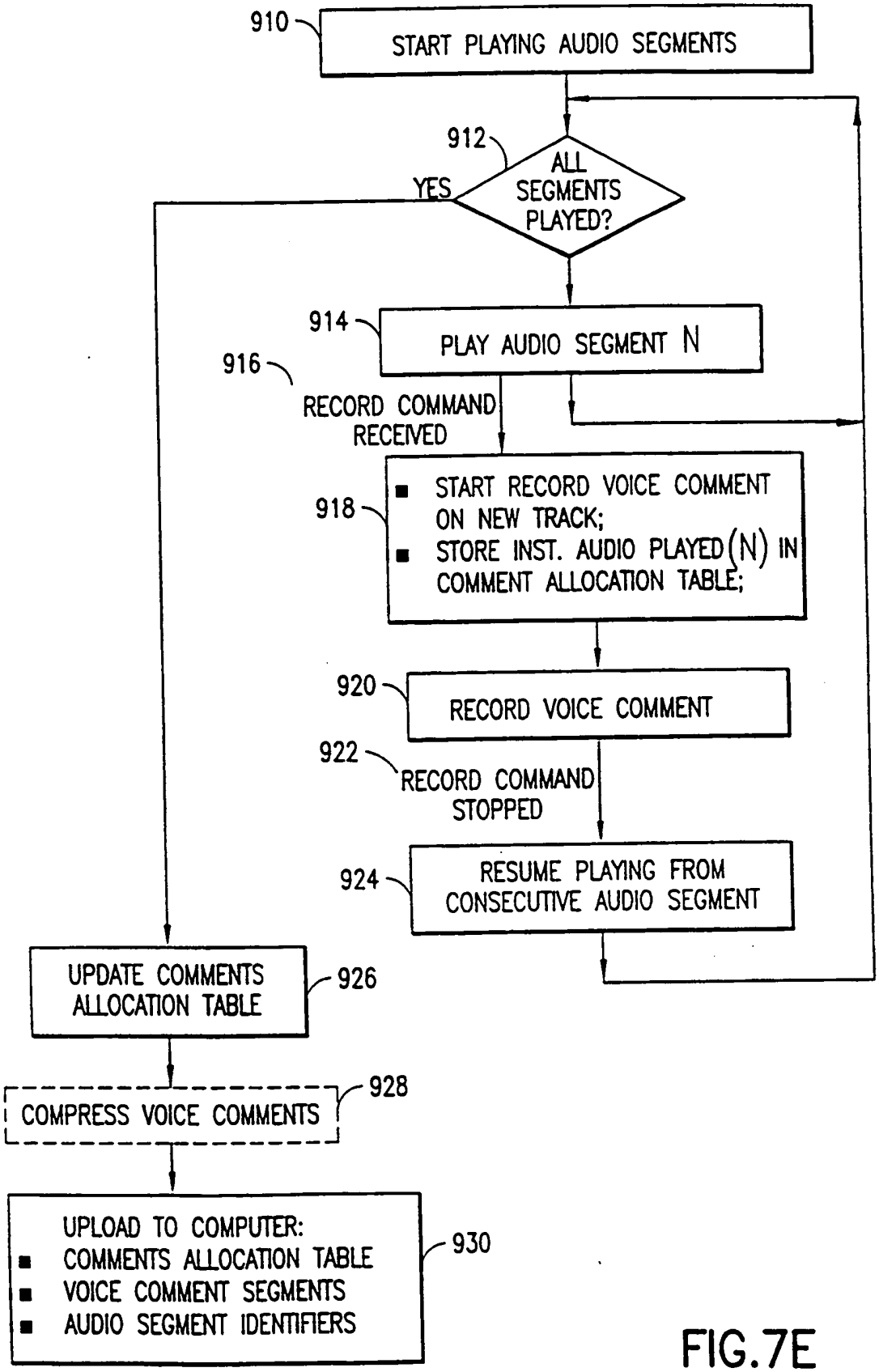
910
START PLAYING AUDIO SEGMENTS
912
ALL SEGMENTS PLAYED?
YES
914
PLAY AUDIO SEGMENT N
916
RECORD COMMAND RECEIVED
918
START RECORD VOICE COMMENT ON NEW TRACK;
STORE INST. AUDIO PLAYED (N) IN COMMENT ALLOCATION TABLE;
920
RECORD VOICE COMMENT
922
RECORD COMMAND STOPPED
924
RESUME PLAYING FROM CONSECUTIVE AUDIO SEGMENT
UPDATE COMMENTS ALLOCATION TABLE
926
928
COMPRESS VOICE COMMENTS
UPLOAD TO COMPUTER:
COMMENTS ALLOCATION TABLE
VOICE COMMENT SEGMENTS
AUDIO SEGMENT IDENTIFIERS
930

FIG.7E

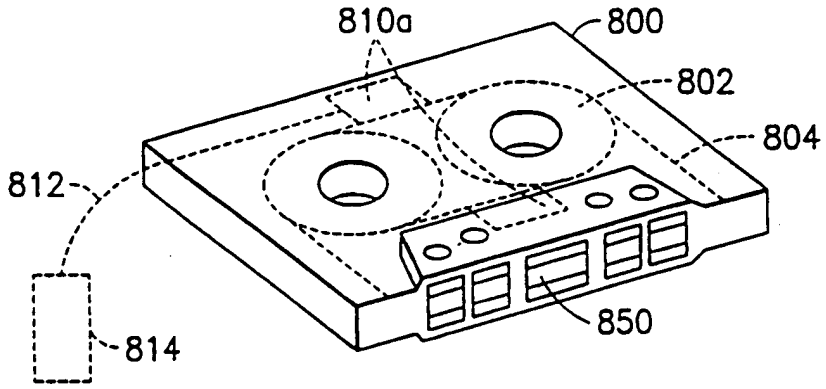

FIG.8A

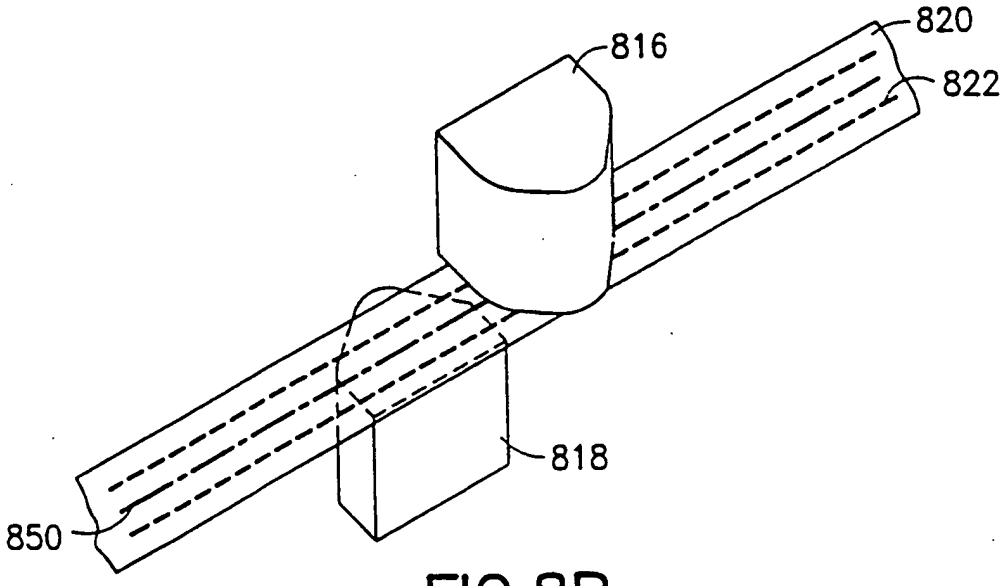

FIG.8B

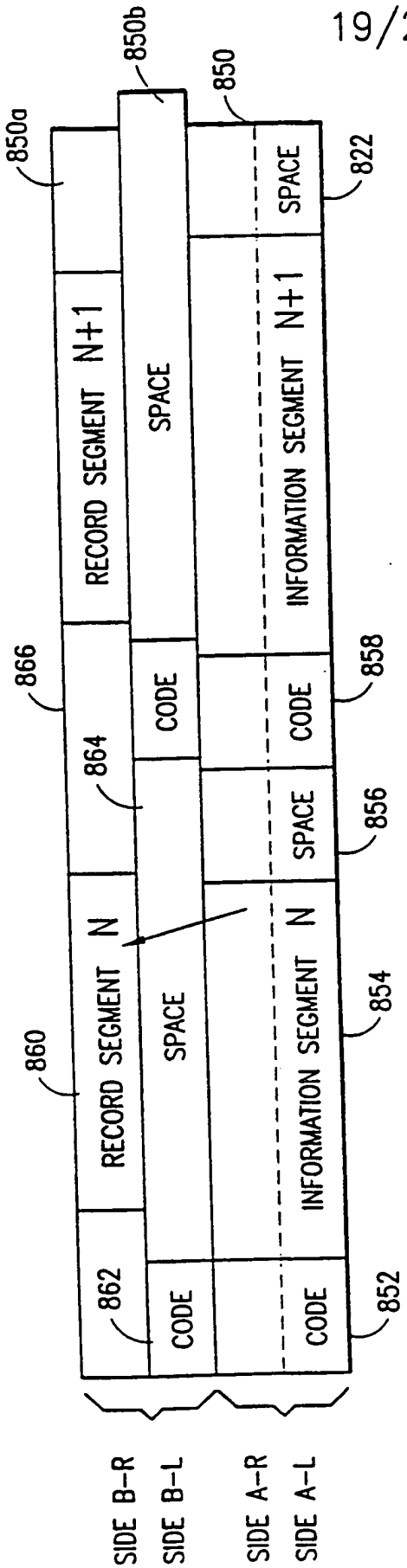
850a
850b
850
822
866
864
858
856
860
854
862
852
RECORD SEGMENT N+1
SPACE
INFORMATION SEGMENT N+1
SPACE
CODE
CODE
RECORD SEGMENT N
SPACE
SPACE
INFORMATION SEGMENT N
CODE
CODE
SIDE B-R
SIDE B-L
SIDE A-R
SIDE A-L

FIG.8C

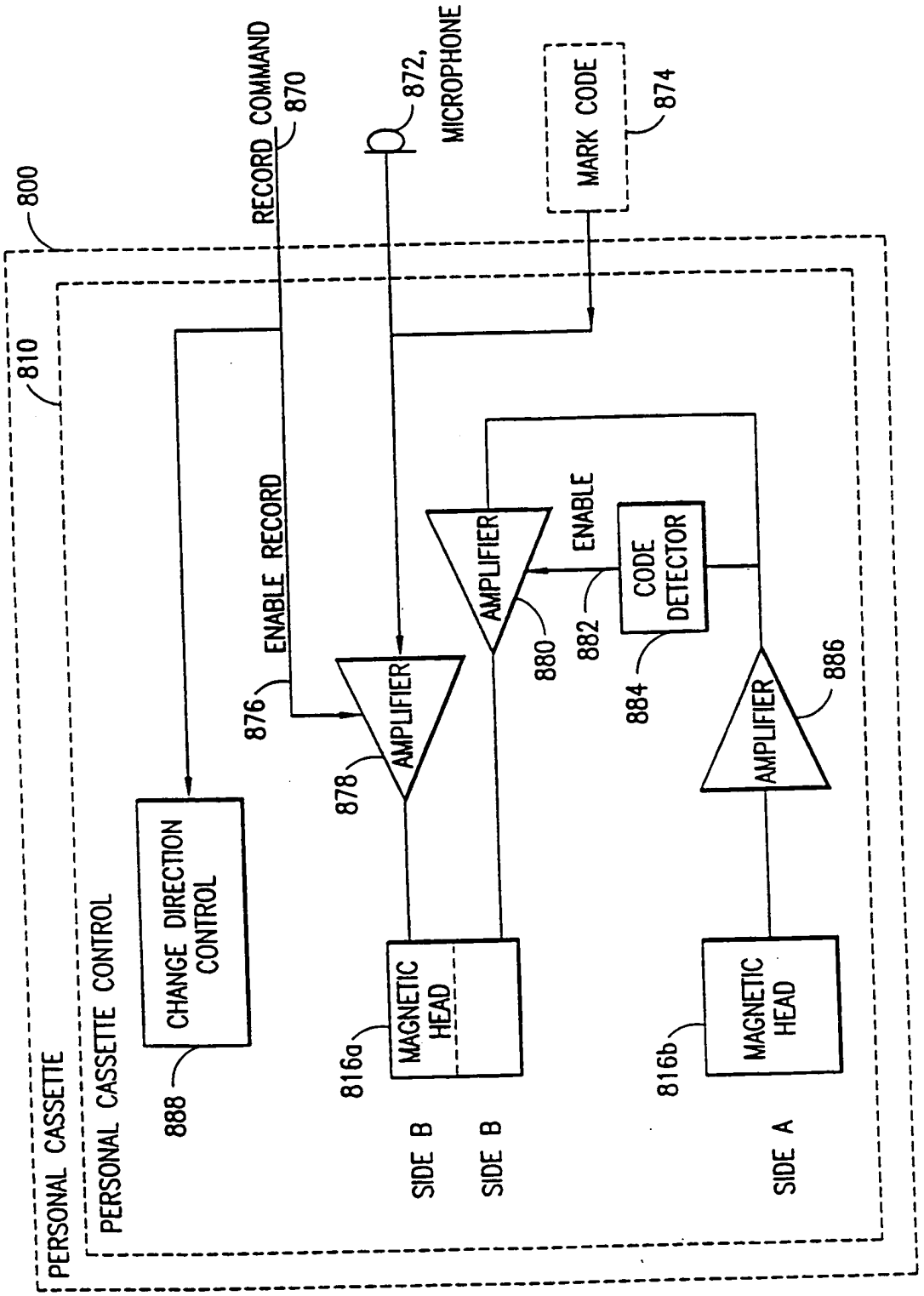
800
PERSONAL CASSETTE
810
PERSONAL CASSETTE CONTROL
RECORD COMMAND
870
872, MICROPHONE
MARK CODE
874
ENABLE RECORD
876
AMPLIFIER
878
AMPLIFIER
880
ENABLE
882
CODE DETECTOR
884
AMPLIFIER
886
CHANGE DIRECTION CONTROL
888
816a
MAGNETIC HEAD
SIDE B
SIDE B
816b
MAGNETIC HEAD
SIDE A

FIG.8D

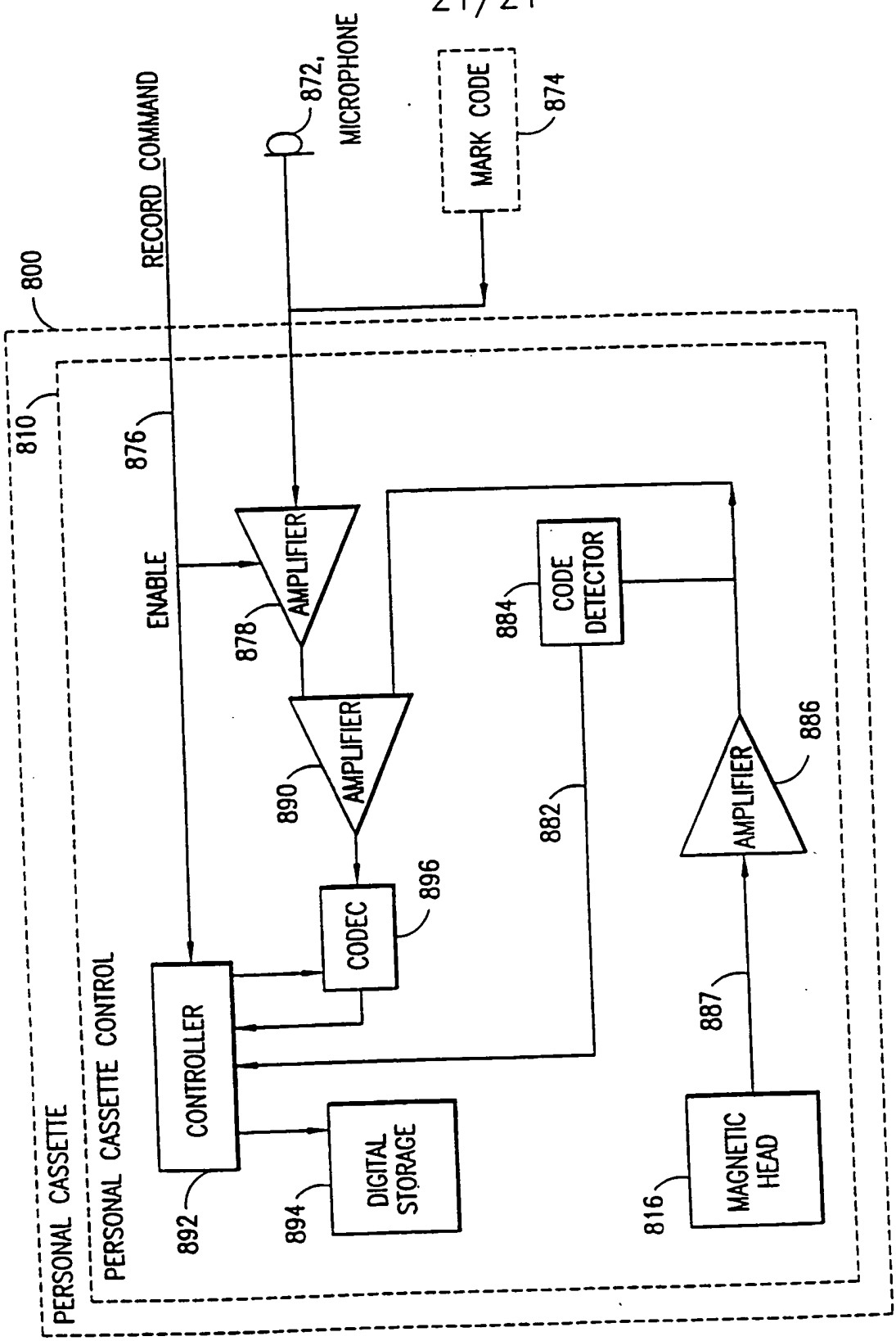
800
PERSONAL CASSETTE
810
PERSONAL CASSETTE CONTROL
RECORD COMMAND
876
ENABLE
872,
MICROPHONE
MARK CODE
874
AMPLIFIER
878
AMPLIFIER
890
CODEC
896
CONTROLLER
892
DIGITAL STORAGE
894
CODE DETECTOR
884
882
AMPLIFIER
886
887
MAGNETIC HEAD
816

FIG.8E